83590A
RF PLUG-IN
(Including Options 002, 004, and 005)

SERIAL NUMBERS

This manual applies directly to HP Model 83590A RF Plug-In having serial number prefix 2146A.

With changes described in Section VII this manual also applies to instruments with serial numbers prefixed 2143A.

For additional information about serial numbers, refer to INSTRUMENTS COVERED BY MANUAL in Section I.

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SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This Operating and Service Manual contains information required to install, operate, test, adjust, and service the Hewlett-Packard Model 83590A RF Plug-in. Figure 1-1 shows the Model 83590A.

1-3. This manual is divided into eight major sections which provide the following information:

a. SECTION I, GENERAL INFORMATION, includes a brief description of the instrument, safety considerations, specifications, supplemental characteristics, instrument identification, options available, accessories available, and a list of recommended test equipment.

b. SECTION II, INSTALLATION, provides information for initial inspection, preparation for use, storage, and shipment.

c. SECTION III, OPERATION, explains the frequency resolution characteristics of the RF Plug-in in CW and swept frequency modes. Operating instructions include FM switch parameter settings, and crystal and power meter leveling instructions. A description of front and rear panel features and Plug-in error codes is also given.

d. SECTION IV, PERFORMANCE TESTS, presents procedures required to verify that performance of the RF Plug-in is in accordance with published specifications.

e. SECTION V, ADJUSTMENTS, presents procedures required to properly adjust and align the Model 83590A RF Plug-in after repair.

f. SECTION VI, REPLACEABLE PARTS, provides information required to order all parts and assemblies.

g. SECTION VII, MANUAL BACKDATING CHANGES, provides backdating information required to make this manual compatible with earlier shipment configurations.

h. SECTION VIII, SERVICE, provides an overall instrument block diagram with troubleshooting and repair procedures. Each assembly within the instrument is covered on a separate Service Sheet which contains a circuit description, schematic diagram, component location diagram, and troubleshooting information to aid in the proper maintenance of the instrument.

1-4. Supplied with this manual is an Operating Information Supplement. This is simply a copy of the first three sections of the manual, which should be kept with the instrument for use by the instrument operator.

1-5. On the front cover of this manual is a "Microfiche" part number. This number may be used to order 10- by 15-centimeter (4- by 6-inch) microfilm transparencies of the manual. Each microfiche contains up to 60 photo duplicates of the manual pages. The microfiche package also includes the latest Manual Changes sheet as well as all pertinent Service Notes.

1-6. Refer any questions regarding this manual, the Manual Changes sheet, or the instrument to the nearest HP Sales/Service Office. Always identify the instrument by model number, complete name, and complete serial number in all correspondence. Refer to the inside rear cover of this manual for a worldwide listing of HP Sales/Service Offices.

1-7. SPECIFICATIONS

1-8. Listed in Table 1-1 are the specifications for the Model 83590A RF Plug-in. These specifications are the performance standards, or limits, against which the instrument may be tested. Table 1-2 lists the RF Plug-in supplemental performance characteristics. Supplemental performance characteristics are not specifications but are typical characteristics included as additional information for the user.

Table 1-1. Specifications for Model 83590A Installed in Model 8350A (1 of 3)

FREQUENCY[1] **Range:** 2 to 20.0 GHz				
Accuracy (25°C ±5°C)	**Frequency Bands (GHz)**			
	2.0 to 7.0	**7.0 to 13.5**	**13.5 to 20.0**	**2.0 to 20.0**
CW Mode	±5 MHz	±10 MHz	±10 MHz	———
All Sweep Modes (Sweep time >100 ms)	±20 MHz	±25 MHz	±30 MHz	±50 MHz[2]
Frequency Markers (Sweep time ≥100 ms)	±20 MHz ±.5% of sweep width	±25 MHz ±.5% of sweep width	±30 MHz ±.5% of sweep width	±50 MHz[2] ±.5% of sweep width
Stability				
With 10% Line Voltage Change	±50 kHz	±100 kHz	±150 kHz	±150 kHz
With 10 dB Power Level Change	±200 kHz	±400 kHz	±600 kHz	±600 kHz
With 3:1 Load SWR	±100 kHz	±200 kHz	±300 kHz	±300 kHz
With Time (in a 10 minute period after one hour warmup)	<±100 kHz	<±200 kHz	<±300 kHz	<±300 kHz
Residual FM, Peak (10 Hz to 10 kHz Bandwidth) (CW Mode with CW Filter)	<5 kHz	<7 kHz	<9 kHz	———

POWER OUTPUT						
	Frequency Bands (GHz)					
	2.0 to 7.0	**7.0 to 13.5**	**13.5 to 18.6**	**13.5 to 20.0**	**2.0 to 18.6**	**2.0 to 20.0**
Maximum Leveled Output Power [2, 3, 4] (25°C)	+10 dBm	+10 dBm	+10 dBm	+8 dBm	+10 dBm	+8 dBm
With Option 002	+8.5 dBm	+8 dBm	+7 dBm	+5 dBm	+7 dBm	+5 dBm
Power Level Accuracy[10] (Internally Leveled)	<±1.3 dB	<±1.3 dB	<±1.4 dB	<±1.4 dB	<±1.5 dB	<±1.5 dB
With Option 002[5] (at 0 dB attenuator step)	<±1.5 dB	<±1.5 dB	<±1.6 dB	<±1.6 dB	<±1.7 dB	<±1.7 dB

Table 1-1. Specifications for Model 83590A Installed in Model 8350A (2 of 3)

POWER OUTPUT (Cont'd)

Minimum Settable Power: −5 dBm
With Option 002: −75 dBm

Attenuator Accuracy (±dB referenced from the 0 dB setting)	**Frequency Range (GHz)**	**Attenuator Setting (dB)**						
		10	**20**	**30**	**40**	**50**	**60**	**70**
	2.0 − 12.4	0.6	0.7	0.9	1.8	2.0	2.2	2.3
	12.4 − 18.0	0.7	0.9	1.2	2.0	2.3	2.5	2.8
	18.0 − 20.0	0.9	1.5	2.5	3.0	3.2	3.3	3.5

Power Variation (at specified Maximum Leveled Power or below)	**Frequency Bands (GHz)**			
	2.0 to 7.0	**7.0 to 13.5**	**13.5 to 20**	**2.0 to 20**
Internally Leveled	±0.7 dB	±0.7 dB	±0.8 dB	±0.9 dB
Externally Leveled Negative Crystal Detector [6] (Sweep time >100 ms)	±0.2 dB	±0.2 dB	±0.2 dB	±0.2 dB
Externally Leveled Power Meter[7]	±0.2 dB	±0.2 dB	±0.2 dB	±0.2 dB
Residual AM in 100 kHz Bandwidth (in dB below carrier and at specified Maximum Leveled Power)	≥50 dB	≥50 dB	≥50 dB	≥50 dB
Spurious Signals (at specified Maximum Leveled Power)				
Harmonics (in dB below carrier)	>25 dB	>25 dB	>25 dB	>25 dB
Non-Harmonics	>50 dB	>50 dB	>50 dB	>50 dB
Output SWR (Internally Leveled)	<1.9	<1.9	<1.9	<1.9
With Option 002	<2.1	<2.1	<2.1	<2.1

Power Sweep[8]	**Frequency Bands (GHz)**					
	2.0 to 7.0	**7.0 to 13.5**	**13.5 to 18.6**	**13.5 to 20.0**	**.01 to 18.6**	**2.0 to 20**
Calibrated Range:[9]	>15 dB	>15 dB	>15 dB	>13 dB	>15 dB	>13 dB
With Option 002:	>13.5 dB	>13 dB	>12 dB	>10 dB	>12 dB	>10 dB

Table 1-1. Specifications for Model 83590A Installed in Model 8350A (3 of 3)

MODULATION [1]

External AM

Maximum Input: 15V

Internal AM

Selectable (by internal jumper in 8350A) to 1 kHz or 27.8 kHz square wave modulation. The 27.8 kHz modulation allows operation with HP 8755A/B/C Swept Amplitude Analyzer.

On/Off Ratio: ≥30 dB below specified Maximum Leveled Power.

Symmetry: 40/60

External FM

Maximum Deviations for Modulation Frequencies:

Modulation Frequency	Cross-Over Coupled	Direct Coupled
DC to 100 Hz	±75 MHz	±12 MHz
100 Hz to 1 MHz	±7 MHz	±7 MHz
1 MHz to 2 MHz	±5 MHz	±5 MHz
2 MHz to 10 MHz	±1 MHz	±1 MHz

GENERAL SPECIFICATIONS [1]

Minimum Sweep Time (over full band): 25 ms

Minimum Sweep Time (over single band): 10 ms

Band Switch Points: Internal band switch points at approximately 7.0 GHz, and 13.5 GHz

RF Output Connector: Type N Female

[1] Unless otherwise noted, all specifications are at the RF OUTPUT connector and at 0° to 55°C.

[2] For temperatures greater than 25°C, maximum leveled output power typically degrades .1 dB/°C.

[3] When RF Output is peaked with PEAK control.

[4] 0.5 dB lower for Option 004.

[5] Attenuator switch points are every 10 dB starting at −5 dBm indicated power.

[6] Excludes coupler and detector variation. Crystal detector output should be between −10 mV and −200 mV at specified maximum leveled power.

[7] Use HP Model 432A/B/C Power Meter. Sweep time typically ≥5 seconds/GHz but not ≤10 seconds.

[8] Power Sweep and Slope Compensation total must not exceed the specified Power Sweep calibrated range.

[9] With Option 002, in power sweep or slope functions, power can exceed the attenuator step by the amount that the Power Sweep calibrated range exceeds 10 dB (i.e., if the calibrated range is 12 dB, power can exceed the attenuator step by 2 dB).

[10] Includes power level variations.

Table 1-2. Supplemental Performance Characteristics for Model 83590A Installed in Model 8350A (1 of 2)

NOTE

Values in this table are not specifications, but are typical characteristics included for user information.

FREQUENCY CHARACTERISTICS [1]

Accuracy (25°C ±5°C)	**Frequency Bands (GHz)**			
	2.0 to 7.0	**7.0 to 13.5**	**13.5 to 20.0**	**2.0 to 20.0**
CW Mode Typically	±2 MHz	±3 MHz	±4 MHz	———
Manual Sweep	≤30 MHz	≤30 MHz	≤30 MHz	≤100 MHz
All Sweep Modes (Sweep time 10 ms to 100 ms)	≤±6 MHz	≤±8 MHz	≤±10 MHz	≤±35 MHz
Sweep Mode Linearity [2]	≤±2 MHz	≤±4 MHz	≤±6 MHz	≤±10 MHz
Stability with Temperature	±200 kHz/°C	±400 kHz/°C	±600 kHz/°C	±600 kHz/°C

OUTPUT CHARACTERISTICS [1]

Power Output

Resolution (Displayed): 0.1 dB

Resolution (Power): Typically ±0.01 dB

Stability with Temperature (at specified Maximum Leveled Power): ±0.1 dB/°C

Power Variation (at specified Maximum Leveled Power or below)

Externally leveled with Negative Crystal Detector: [5] ±0.25 dB

Spurious Signals (in dB below carrier and at specified Maximum Leveled Power)	**Frequency Bands (GHz)**			
	2.0 to 7.0	**7.0 to 13.5**	**13.5 to 20.0**	**2.0 to 20.0**
Harmonics and Subharmonics	>40 dB	>35 dB	>35 dB	>35 dB
Non Harmonics Typically	>55 dB	>55 dB	>55 dB	>55 dB

Power Sweep [3]

Accuracy (Including Linearity): Typically ±1.5 dB

Resolution (Displayed): 0.1 dB

Slope Compensation [3]

Linearity: Typically <0.2 dB

Calibrated Range: [4] Up to 5 dB/GHz; up to 15 dB for full sweep range

Resolution (Displayed): 0.01 dB/GHz

Table 1-2. Supplemental Performance Characteristics for Model 83590A Installed in Model 8350A (2 of 2)

MODULATION CHARACTERISTICS [1]

External AM

Frequency Response: Typically 100 kHz
Input Impedance: Approximately 10k Ohm
Range of Amplitude Control: Typically 15 dB
Sensitivity: Typically 1 dB/V

Pulse In

TTL Compatible: Logic high = RF on, Logic low = RF off
7.0 to 20.0 GHz: Squarewave modulation up to 30 kHz
2.0 to 7.0 GHz:
Rise/Fall Time: Typically 10 ns
Minimum Pulse Width:
Leveled: Typically 1 μs
Unleveled Power level set to +20 dBm: Typically 100 ns

External FM

Frequency Response (DC to 2 MHz): Typically ±3 dB
Sensitivity (Switch selectable)
Typically −20 MHz/V (FM Mode)
Typically −6 MHz/V (Phase-Lock Mode)
Imput Impedance: 2000 Ohms nominal

GENERAL CHARACTERISTICS [1]

Frequency Reference Output: 1 V/GHz ±25 mV (2 to 18 GHz) rear panel BNC output.
Auxiliary Output: Rear panel 2 to 7 GHz fundamental oscillator output, nominally 1 dBm.
Weight: Net 6.0 kg (13.2 lb.); Shipping 9.2 kg (20 lb.)

1 Unless otherwise noted, all characteristics are at the RF OUTPUT connector and at 0°to 55°C.
2 With respect to the SWEEP OUT voltage.
3 Power Sweep and Slope Compensation must not exceed the specified Power Sweep calibrated range.
4 With Option 002 in power sweep or slope functions, power can exceed attenuator step by the amount that the Power Sweep calibrated range exceeds 10 dB (i.e., if the calibrated range is 12 dB, power can exceed the attenuator step by 2 dB).
5 Excludes coupler and detector variation. Crystal detector output should be between −10 mV and −200 mV at specified maximum leveled power.

1-9. SAFETY CONSIDERATIONS

1-10. This product has been manufactured and tested in accordance with international safety standards. Before operation, this product and related documentation must be reviewed for familiarization with safety markings and instructions. A complete listing of Safety Considerations precedes Section I of this manual.

1-11. INSTRUMENTS COVERED BY MANUAL

1-12. Attached to the rear panel of the instrument is a serial number plate. A typical serial number plate is shown in Figure 1-2. The serial number is in two parts. The first four digits followed by a letter comprise the serial number prefix. The last five digits form the sequential suffix that is unique to each instrument. The content of this manual applies directly to instruments having the same serial number prefix as those listed on the title page of this manual under SERIAL NUMBER.

1-13. An instrument manufactured after the printing of this manual may have a serial prefix that is not listed on the title page. An unlisted serial prefix indicates that the instrument is different from those documented in this manual. The manual for the instrument is then supplied with a Manual Changes supplement that contains information which documents the differences.

1-14. In addition to change information, the Manual Changes supplement contains information for correcting errors in the manual. To keep this manual as current as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is keyed to the manual's print date and part number, both of which appear on the title page. Complimentary copies of the Manual Changes supplement are available on request from Hewlett-Packard.

1-15. For information concerning a serial number prefix that is not listed on the title page or in the Manual Changes Supplement, contact your nearest Hewlett-Packard Sales/Service Office.

1-16. DESCRIPTION

1-17. The Model 83590A is an RF Plug-in which has been designed for use with the Model 8350A

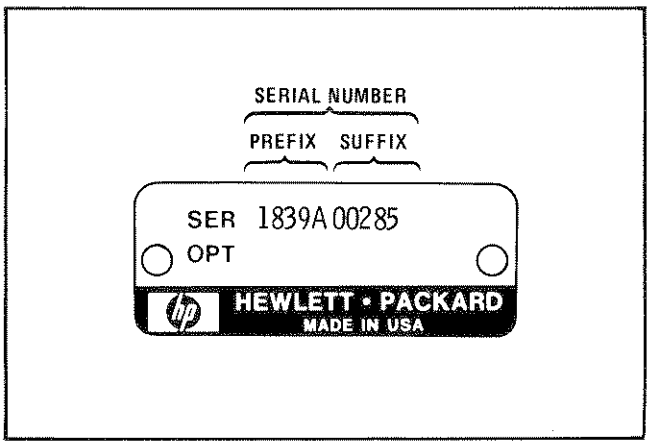


Figure 1-2. Typical Serial Number Plate

Sweep Oscillator. The Model 83590A covers the frequency range of 2 to 20.0 GHz in three bands. A YIG oscillator is used as the tunable RF frequency source of all bands. The YIG oscillator fundamental frequency is used for Band 1 (2.0 to 7.0 GHz). A YIG Tuned Multiplier (YTM) is used to multiply the YIG oscillator frequency for Bands 2 and 3 (6.9 to 13.5 GHz and 13.4 to 20.0 GHz).

1-18. Model 83590A front panel functional controls, pushbuttons, and the Rotary Pulse Generator (RPG), are monitored by the Model 8350A via the RF Plug-in interface circuits. The Model 8350A generates a tuning voltage according to the mode of operation (CW, START/STOP, CF/ΔF). This signal is scaled and offset by the Plug-in to provide a voltage ramp (in swept modes) proportional to the YIG oscillator frequency. The Model 83590A tuning circuits accept the tuning ramp output from the Model 8350A and convert it to a current which drives the YIG oscillator tuning coil.

1-19. The standard Model 83590A offers internally leveled RF output power. Internal (INT), External (EXT), and Power Meter (MTR) leveling are available as selected by the front panel pushbuttons. A front panel EXT/MTR ALC input connector and gain control (CAL) are provided to use with an external leveling loop. A front panel LED indicates when the RF output becomes unleveled. The RF output level is controlled by the Model 83590A RPG, the Model 8350A data entry controls (keypad and step keys), or through HP-IB control via the Model 8350A.

1-20. A power sweep function allows the RF output power to be swept at least 10 dB during CW mode or swept frequency modes. Power sweep is

selected by the front panel POWER SWEEP pushbutton. Slope compensation control is also available by selecting the SLOPE pushbutton and rotating the Model 83590A RPG or manipulating the Model 8350A data entry controls. The power sweep function and slope compensation may both be selected and modified through HP-IB control via the Model 8350A.

1-21. The RF output may be internally or externally amplitude modulated, or externally frequency modulated. Internal square wave modulation frequency is selectable by a Model 8350A internal jumper to be either 1 kHz or 27.8 kHz (for use with the Model 8755 Swept Amplitude Analyzer). Rear panel BNC connectors accept an external AM or FM frequency. FM coupling (direct coupled or cross-over) and sensitivity is selected by an internal configuration switch in the Model 83590A. Refer to Section III, Operation, of this manual for detailed information on the configuration switch.

1-22. A rear panel 1V/GHz signal corresponds to the RF output frequency. This output voltage may by used as a reference for pretuning external equipment in phase locking applications. (The Model 8410B/8411A Network Analyzer utilizes this output in such a configuration.)

1-23. The RF output may be turned off by the RF ON/OFF pushbutton. RF power ON is indicated by the LED in the center of the pushbutton. Additionally, in CW mode, the CW FILTER, when selected, places a capacitor across the YIG oscillator tuning coil to filter high frequency noise which would appear at the RF output. All front panel functions, with the exception of the EXT/MTR ALC CAL adjustments, may be set or altered by computer control via the HP-IB bus connection on the Model 8350A.

1-24. OPTIONS

1-25. Option 002, 70 dB Attenuator

1-26. Option 002 instruments contain a digitally controlled attenuator just before the RF output. Up to 70 dB of attenuation in 10 dB steps is automatically selected as required to attenuate the RF output power to the indicated level. The continuously variable power level function operates as in a standard instrument with the data entry controls.

1-27. Option 004, Rear Panel RF Output

1-28. Option 004 instruments have the Type N RF output connector and the BNC EXT/MTR ALC input connector on the rear panel instead of the front panel.

1-29. Option 005, APC-7 ®* RF Output Connector

1-30. Option 005 instruments have an APC-7 RF output connector.

1-31. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-32. To have a complete operating sweep oscillator unit, the Model 83590A RF Plug-in must be installed in a Model 8350A Sweep Oscillator. Refer to Section II, Installation, in this manual for a detailed description of RF Plug-in installation.

1-33. EQUIPMENT AVAILABLE

1-34. Service Accessories

1-35. A Service Accessory Kit (HP Part Number 08350-60020) is available for servicing the Model 83590A RF Plug-in and the Model 8350A Sweep Oscillator. HP Part Numbers for the individual pieces of the kit are provided in Table 1-3. The accessory kit includes:

- Two 44-pin printed circuit board extenders. These boards have keyed slots which allow them to be used in each of the keyed pc board receptacles in the Model 83590A, and in the Model 8350A as well.
- An RF Plug-in extender cable set that provides all electrical connections when the RF Plug-in is removed from the Sweep Oscillator. The RF Plug-in Interface connector (P2) and the Power Supply Interface connector (P1) are extended by separate cables.
- One Hex Balldriver for use in Model 8350A front panel repairs.
- One 16-pin and one 20-pin I.C. Test Clip for probing integrated circuits.

1-36. A listing of service accessories available including service cables, wrenches, adapters, and extender boards is given in Table 1-3.

*APC-7® is a registered trademark of the Bunker-Ramo Corporation.

1-37. Model 8410B/8411A Network Analyzer

1-38. The Model 8350A Sweep Oscillator, with the Model 83590A RF Plug-in installed, is compatible with the HP Model 8410B Network Analyzer system. The combination of the Model 8410B Network Analyzer, the Model 8411A Frequency Converter, and an appropriate display Plug-in forms a phasemeter and a ratiometer for direct phase and amplitude ratio measurement on RF voltages. These measurements can be made on single frequencies and on swept frequencies from 2 to 18 GHz. The Model 8350A/83590A combination is capable of operation over this full frequency range. The Model 8410B has an Auto-Frequency range mode which gives it the capability of automatically tracking the Model 8350A Sweep Oscillator over octave and multi-octave frequency bands. Two interconnections to the Model 8350A are necessary to ensure that the Model 8410B will phase lock properly. The Model 8410B Source Control Cable (HP 08410-60146) connects the Model 8410B rear panel SOURCE CONTROL connector to the Model 8350A rear panel PROGRAMMING CONNECTOR. Additionally, the Model 83590A RF Plug-in rear panel 1V/GHz output connects to the Model 8410B rear panel FREQ REF INPUT. The Model 8410B Source Control Cable connector pins and signals are illustrated in the Model 8350A Sweep Oscillator Operating and Service Manual.

1-39. Model 8755 Frequency Response Test Set

1-40. The Model 8350A Sweep Oscillator with the Model 83590A RF Plug-in installed is compatible with the Model 8755 Frequency Response Test Set for broadband swept scalar measurements. The Model 8350A provides internal 27.8 kHz square wave amplitude modulation of the RF output, eliminating unnecessary cable connections to the Model 8755 or the use of an external modulator. The Model 8350A can also produce alternate sweeps through use of the ALT n function which works in conjunction with the channel switching circuits in the Model 8755C. This permits Channel 1 on the Model 8755C to respond only to the Model 8350A current state and Channel 2 to the alternate state. A single cable (HP Part Number 8120-3174) connects between the Model 8350A rear panel ALT SWP INTERFACE connector and the Model 8755C front panel ALT SWP INTERFACE connector.

1-41. Power Meters and Crystal Detectors

1-42. The RF output can be externally leveled using the HP Model 432 Power Meter or negative polarity output crystal detectors. Refer to Section III Operation of this manual for detailed information on leveling techniques that may be used with the Model 8350A/RF Plug-in combination.

NOTE

The Model 435A and 436A Power Meters should not be used in Model 8350A/Model 83590A external leveling systems.

1-43. RECOMMENDED TEST EQUIPMENT

1-44. Equipment required for testing and adjusting the instrument is listed in Table 1-4. Other equipment may be substituted if it meets or exceeds the critical specifications indicated in the table.

Table 1-3. Service Accessories Available

Name	HP Part Number	Description
44-pin printed circuit board extender	08350-60031*	Extends printed circuit boards
RF Plug-in Extender Cables	08350-60034* 08350-60035*	Extends RF Plug-in Interface connector (P2) Extends RF Plug-in Power Supply Interface connector (P1)
Adjustment Tool	8830-0024	Fits miniature adjustment slot on potentiometers
Wrenches	08555-20097 8710-0946	5/16"slotted box/open end 15/64" open end
Service Cables	8120-1578 83525-60019	18" Coax with SMA (m) connector on each end 10" coax with SMB snap on (f) and SMA (m)
Adapters	1250-07777 1250-0082 1250-1404 1250-1158 1250-0674 1250-0675 1250-0069	Type N (f) to BNC (m) Type N (m) to BNC (m) Type N (f) to SMA (f) SMA (f) to SMA (f) SMA (f) to SMB (m) SMA (f) to SMC (m) SMB snap on (m) to SMB snap on (m)
Hex Balldriver	8710-0523*	Removes front panel hold down plate hex screws in 8350A.
IC Test Clip	1400-0979* 1400-0979*	16-pin IC test clip 20-pin IC test clip

*These items are included in a Service Accessories Kit HP Part No. 08350-60020 (2 board extenders are included in this kit).

Table 1-4. Recommended Test Equipment (1 of 3)

Instrument	Critical Specifications	Recommended Model	Use*
Sweep Oscillator	No substitute	HP 8350A	P,A,T
Digital Voltmeter (DVM)	Range: –50V to +50V Accuracy: ±0.01% Input Impedance: ≥10M Ohms	HP 3456A	A,T
Oscilloscope	Dual Channel Bandwidth: dc to 100 MHz Vertical Sensitivity: ≤5 mV/DIV Horizontal Sweep Rate: ≤0.1μ S/DIV External Sweep Capability	HP 1740A	P,A,T
Oscilloscope Probe	1:1 General Purpose Probe	HP 10009B	A
Frequency Counter	Frequency Range: 2 to 20.0 GHz Input Impedance: 50 Ohms Resolution: ≤1 MHz	HP 5343A	P,A
Spectrum Analyzer	Frequency Range: 2 to 20.0 GHz Residual FM: <100 Hz	HP 8565A or HP 8566A	P,T

Table 1-4. Recommended Test Equipment (2 of 3)

Instrument	Critical Specifications	Recommended Model	Use*
Swept Amplitude Analyzer	Capable of Transmission Measurements Power Resolution: ≤0.25 dB	HP 8755C	A
Display Mainframe	Compatible with 8755C Swept Amplitude Analyzer	HP 180T/TR, 182T/TR	A
Detectors (2)	Compatible with Swept Amplitude Analyzer Frequency Range: 2 to 20.0 GHz Power Range: −20 to +10 dBm	HP 11664B	A
Frequency Meter	Frequency Accuracy: ≤0.17% Calibration Increments: ≤2 MHz		
	Frequency Range: 2.0 to 4.0 GHz	HP 536A	A
	4.0 to 12.4 GHz	HP 537A	A
	12.4 to 18 GHz	HP P532A	A
Function Generator	Frequency Range: 0.1 Hz to 10 MHz Sinewave and squarewave output Output Level: 10Vp-p into 50 Ohms Output Level Flatness: ≤±3% from 10 Hz to 100 kHz ≤±10% from 100 kHz to 10 MHz	HP 3312A	P,A,T
Power Meter	Power Range: −20 to +10 dBm (No substitute when used for external power meter leveling).	HP 432A	P,A
Thermistor Sensor	Frequency Range: 2 to 20.0 GHz Maximum SWR: ≤1.75	HP 8478B	P,A
Thermistor Sensor	Frequency Range 18 to 20.0 GHz Maximum SWR: ≤2.0	HP K486	P,A
Adaptor	Waveguide to APC 3.5 (f) (for use with HP K486)	HP K281C	A
Power Meter	Power Range: 1 μW to 100 mW	HP 436A	P,A
Power Sensor	Frequency Range 2 to 20.0 GHz	HP 8485A	P,A
Crystal Detector**	Frequency Response: 2 to 20.0 GHz Maximum Input Power: 100 mW	HP 8473C	P,A
Attenuator**	Frequency Range: 2 to 20.0 GHz Maximum Input Power: +20 dBm Attenuation:		
	20 dB ±1.0 dB	Weinschel Model M9-20	P
	20 dB ±0.8 dB	Weinschel Model M9-10	P,A
	6 dB ±0.6 dB	Weinschel Model M9-6	P
	3 dB ±0.5 dB	Weinschel Model M9-3	P

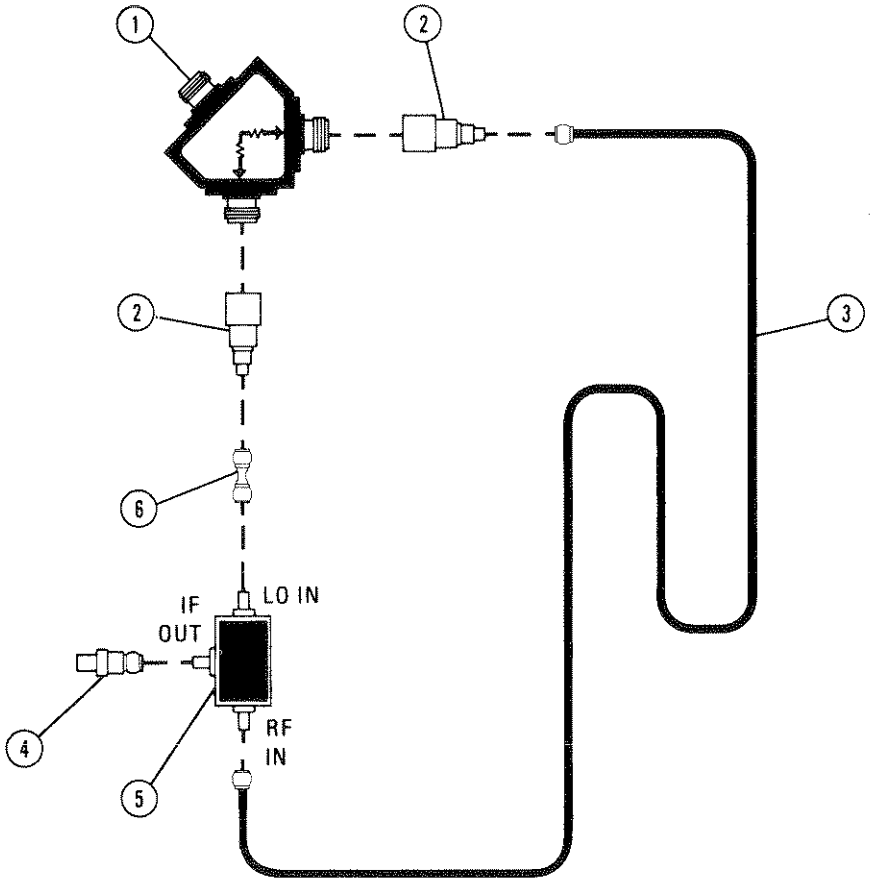
Table 1-4. Recommended Test Equipment (3 of 3)

Instrument	Critical Specifications	Recommended Model	Use*
Power Splitter**	Frequency Range: 2 to 20.0 GHz Maximum Input Power: ⩾+20 dBm	Weinschel Model 1579A	P,A
Directional Coupler	Frequency Range: 2.0 to 18 GHz Nominal Coupling: ⩾22 dB Maximum Coupling Variation: ± 1 dB Minimum Directivity: 26 dB	HP 11691D	P
RMS Voltmeter	dB Range: −20 to −70 dBm (0 dBm = 1 mV into 600 ohms) Frequency Range: 10 Hz to 10 MHz Accuracy: ±5% of full scale	HP 3400A	P
Air Line Extension (2 required)	Impedance: 50 Ohms Frequency Range: dc to 18 GHz Reflection Coefficient: 0.018 to 0.001 (times the frequency in GHz)	HP 11567A	P
Step Attenuator	Frequency Range: dc to 18 GHz Incremental Attenuation: 0 to 70 dB in 10 dB steps Calibration Accuracy: ⩽±0.1 dB at all steps	HP 8495B Option 890	P
Adjustable Short	Frequency Range: 2 to 18 GHz Impedance: 50 ±1.5 Ohms	Maury Microwave 1953-2	P
DC Power Supply	DC Output: 0 to 6.5Vdc ±0.05 Vdc	HP 6214A	A
50 Ohm Termination	Type N, 50 ±0.5 Ohms	HP 909A	P
Delay Line Discriminator	Refer to Figure 1-3.		P, A
PC Board Extender	44-pin, extends printed circuit boards	HP Part No. 08350-60031	A, T

* P = Performance Test; A = Adjustments; T = Troubleshooting

**For testing at frequencies of ⩽18 GHz, the following equipment may be substituted:

ATTENUATORS	POWER SPLITTER	CRYSTAL DETECTOR
20 dB HP 8419B Option 020	HP 11667A	HP 8470B
10 dB HP 8419B Option 010		
6 dB HP 8491B Option 006		
3 dB HP 8491B Option 003		



Item	Description	HP Part Number
1	Power Splitter	HP 11667A
2	Adapter: Type N Male to SMA Female (2 required)	1250-1250
3	Delay Line: >1 meter (3 feet) in length, SMA male connectors	08503-20038
4	Adapter: BNC Female to Male SMA	1250-1200
5	Mixer: Double Balanced 1 to 12 GHz: RHG Electronics Part No. DM 1-12 1 to 18 GHz: RHG Electronics Part No. DM 1-18 RHG Electronics Laboratories, Inc. Deer Park, NY 11729	 0960-0451 0960-0543
6	Adapter: SMA Male to SMA Male	1250-1159

Figure 1-3. Delay Line Discriminator

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section provides installation instructions for the Model 83590A RF Plug-in. This section also includes information about initial inspection, damage claims, preparation for use, packaging, storage, and shipment.

2-3. INITIAL INSPECTION

2-4. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment should be as shown in Figure 1-1. Procedures for checking electrical performance are given in Section IV, Performance Tests, of this Operating and Service Manual. If the instrument combination does not pass the electrical Performance Tests, refer to Section V, Adjustments, of this manual. If, after the adjustments have been made, the instrument combination still fails to meet specifications, and a circuit malfunction is suspected, refer to troubleshooting procedures in Section VIII, Service, in this manual. If the instrument does not pass the above electrical tests, if the shipment contents are incomplete, or if there is mechanical damage or defect, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or if the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for carrier's inspection. The HP office will arrange for repair or replacement without waiting for claim settlement.

2-5. PREPARATION FOR USE

2-6. Power Requirements

2-7. When the Model 83590A RF Plug-in is properly installed, it obtains all power through the rear panel interface connector from the Model 8350A Sweep Oscillator.

2-8. RF Plug-in Configuration Switch

2-9. The Model 83590A RF Plug-in has a configuration switch (A3S1) located on the A3 Digital Interface Board. This switch must be preset prior to RF Plug-in operation in the Model 8350A. The configuration switch is an 8-section multiple switch. Each separate switch corresponds to a separate RF plug-in function such as FM sensitivity selection, FM input coupling selection (direct coupled or cross-over), RF power level at power on (maximum or off), and Option 002 Step Attenuator operation. Refer to Section III, Operation, in this manual for a complete description of the configuration switch and instructions on how to set the switches.

2-10. Interconnections

2-11. There are two rear panel interconnections from the Model 83590A RF Plug-in to the Model 8350A Sweep Oscillator. These are the RF Plug-in Interface connector (P2) and the Power Supply Interface Connector (P1). A complete listing of pins and associated signals for these connectors is provided in Figures 2-1 and 2-2.

2-12. Mating Connectors

2-13. All of the externally mounted connectors on the Model 83590A are listed in Table 2-1. Opposite each connector is an industry identification, the HP part number of a mating connector, and the part number of an alternate source for the mating connector. For HP part numbers of the externally mounted connectors themselves, refer to Section VI, Replaceable Parts, of this manual.

2-14. Operating Environment

2-15. Temperature. The instrument may be operated in temperatures from 0°C to +55°C.

2-16. Humidity. The instrument may be operated in environments with humidity from 5% to 80% relative at +25°C to +40°C. However, the instrument should also be protected from temperature extremes which cause condensation within the instrument.

2-17. Altitude. The instrument may be operated at altitudes up to 4572 meters (15,000 feet).

Table 2-1. Model 83590A Mating Connectors

83590A Connector		Mating Connector	
Connector Name	Industry Identification	HP Part No.	Alternate Source
J1 RF INPUT	Type N (f)	1250-0882	Specialty Connector 25-P117-2
J2 EXT/MTR ALC INPUT	BNC (f)	1250-0256	Specialty Connector 25-P118-1
J3 AUX OUTPUT	Type N (f)	1250-0882	Specialty Connector 25-P117-2
J4 PULSE IN	BNC (f)	1250-0256	Specialty Connector 25-P118-1
J5 1V/GHz	BNC (f)	1250-0256	Specialty Connector 25-P118-1

2-18. Cooling. When the Model 83590A RF Plug-in is properly installed in the Model 8350A Sweep Oscillator, it obtains all of its cooling airflow by forced ventilation from the fan in the Model 8350A. A diagram showing the various cooling airflow paths within the sweep oscillator is given in Section II, Installation, of the Model 8350A Sweep Oscillator Operating and Service Manual. Ensure that all airflow passages in the Model 8350A and the Model 83590A are clear before installing the RF Plug-in in the Sweep Oscillator.

2-19. Installation Instructions

2-20. To operate as a completely functional Sweep Oscillator, the Model 83590A RF Plug-in must be installed in a Model 8350A Sweep Oscillator. To install the Model 83590A RF Plug-in in the Model 8350A Sweep Oscillator:

a. Set the Model 8350A mainframe LINE switch to OFF.

b. Remove all connectors and accessories from the front and rear panel connectors of the Model 83590A to prevent them from being damaged.

c. Position the RF Plug-in unit latching handle in the fully raised position. The latching handle should spring easily into the raised position and be held by spring tension.

d. Ensure that the Model 8350A RF Plug-in channel is clear, align the RF Plug-in in the channel and slide it carefully into place toward the rear of the channel. It should slide easily without binding.

e. The drawer latch handle slot will engage with the locking pin just before the RF Plug-in is fully seated in position.

f. Press the latch handle downward,while still pushing in on the RF Plug-in, until the drawer latch is fully closed and the front panel of the RF Plug-in is aligned with the Sweep Oscillator front panel.

2-21. STORAGE AND SHIPMENT

2-22. Environment

2-23. The instrument may be stored or shipped in environments within the following limits:

Temperature..... −40°C to +75°C
Humidity..... 5% to 95% relative at 0° to +40°C
Altitude..... Up to 15240 meters (approximately 50,000 feet)

2-24. The instrument should also be protected from temperature extremes which may cause condensation in the instrument.

2-25. Packaging

2-26. Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. A complete diagram and listing of packaging materials used for the Model 83590A is shown in Figure 2-3. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number (located on rear panel serial plate). Mark the container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-27. Other Packaging. The following general instructions should be used for repackaging with commercially available packaging materials:

a. Wrap the instrument in heavy paper or plastic. If shipping to a Hewlett-Packard Office or Service Center, attach a tag indicating the type of service required, return address, model number, and full serial number.

b. Use a strong shipping container.

c. Use enough shock-absorbing material around all sides of the instrument to provide a firm cushion and to prevent movement inside the container. Protect the control panel with cardboard.

d. Seal the shipping container securely.

e. Mark the shipping container FRAGILE to assure careful handling.

f. In any correspondence, refer to the instrument by model number and full serial number.

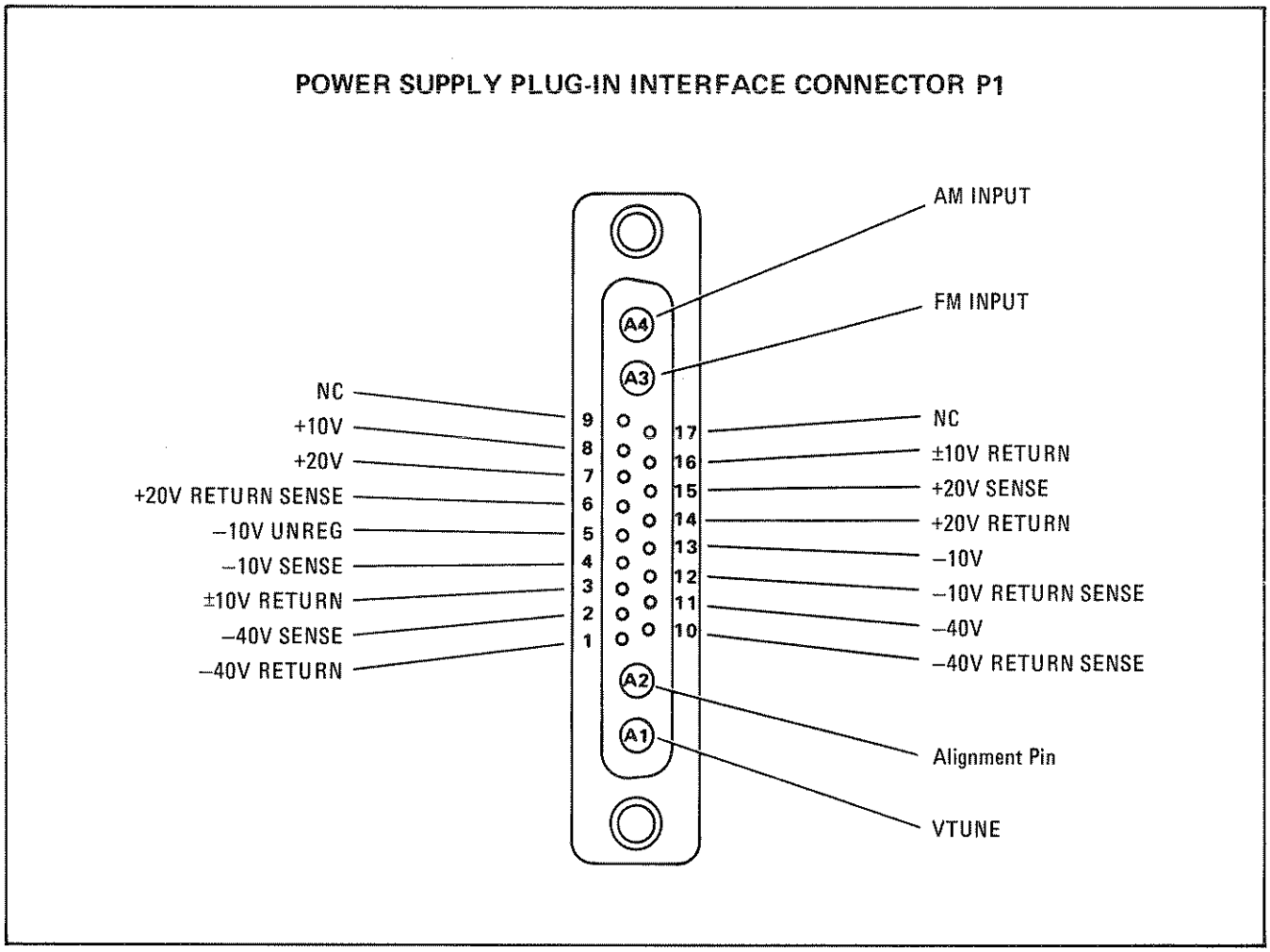


Figure 2-1. Interface Signals on Connector P1

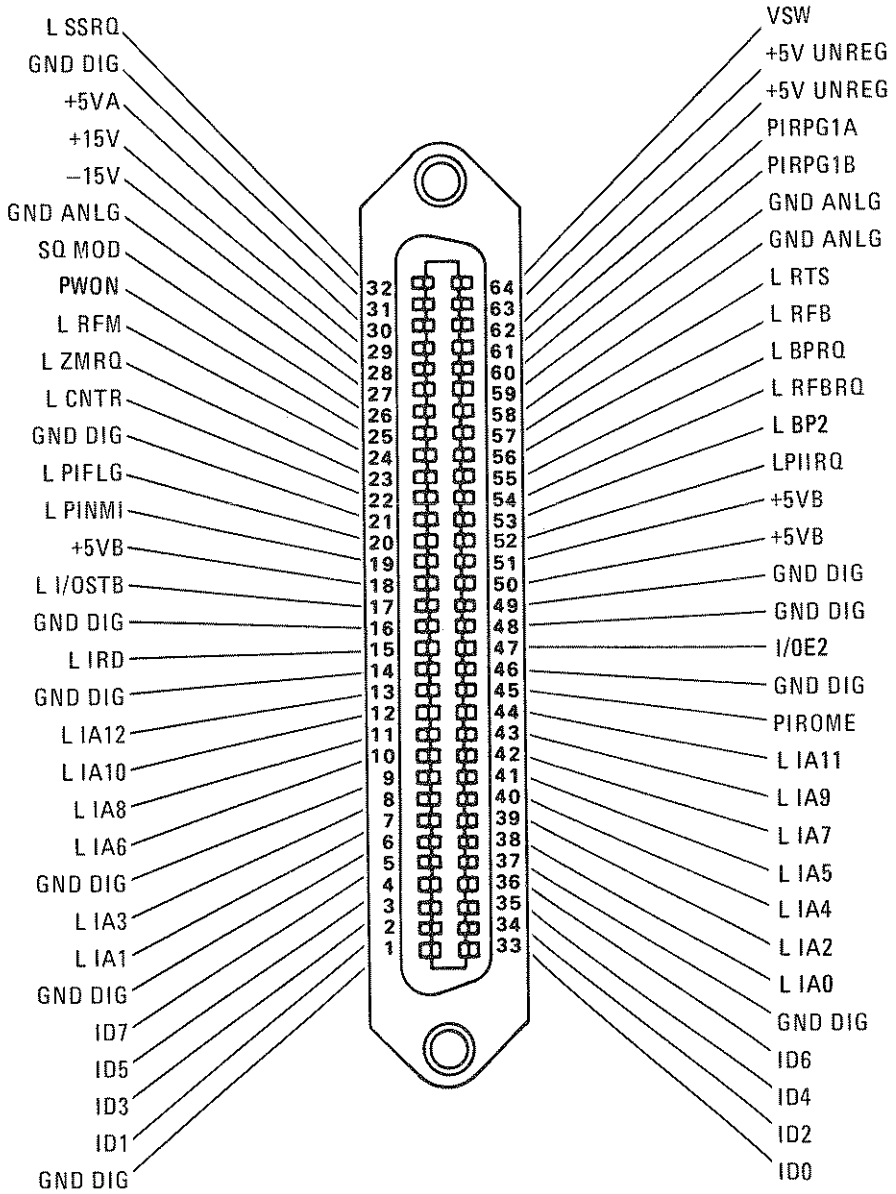
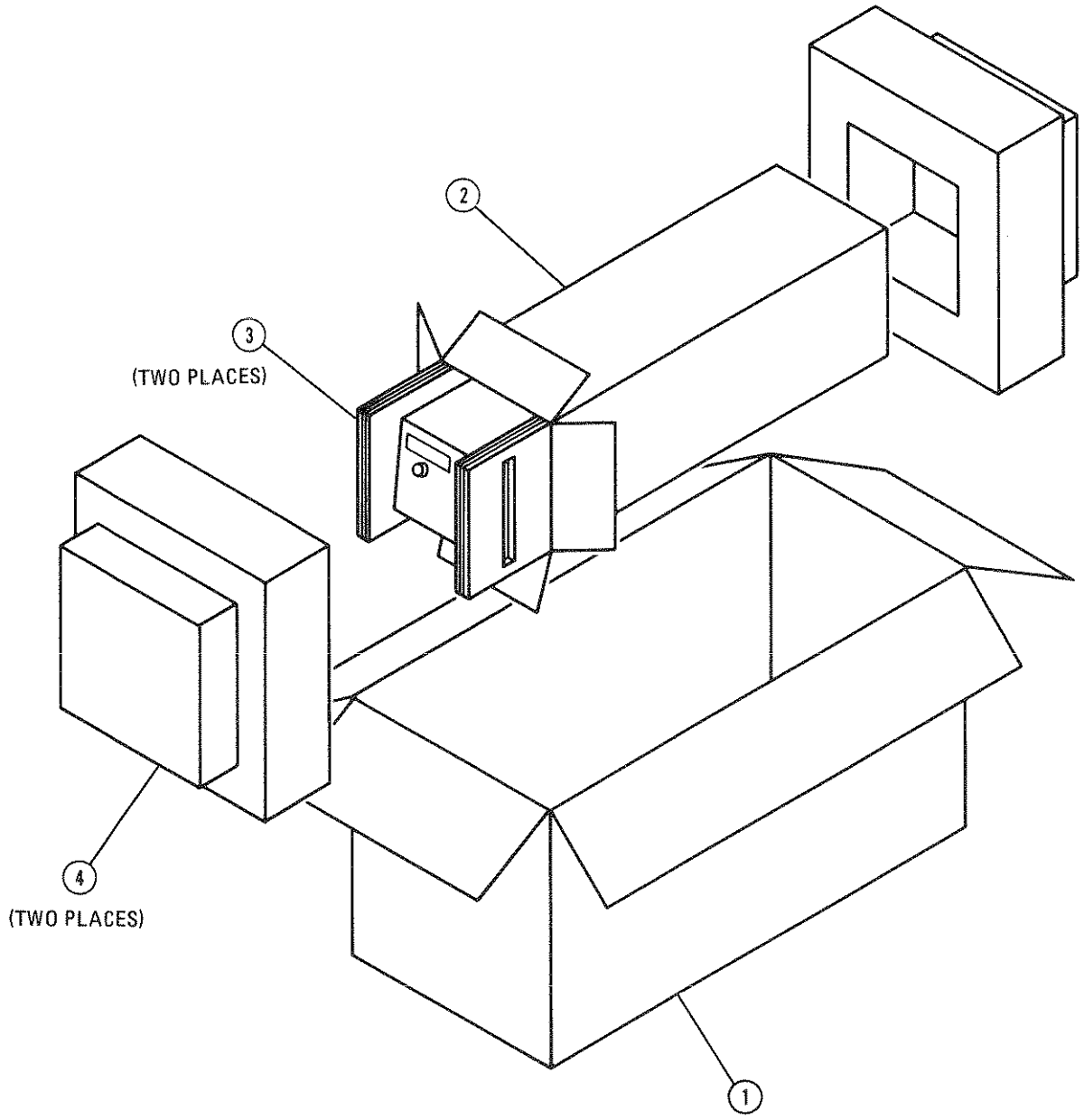


Figure 2-2. Interface Signals on Connector P2



Item	Quantity	HP Part Number	C D	Description
1	1	9211-3515	6	Outer Carton
2	1	9211-3514	5	Inner Carton
3	2	9220-3409	6	Side Pads – Corrugated Cardboard
4	2	9220-3406	3	Foam Pads
	1	9222-0352	6	Poly Bag – to cover instrument

Figure 2-3. Packaging for Shipment Using Factory Packaging Materials

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section is divided into four major sections. Operating Characteristics explains the bandswitching and frequency resolution characteristics in CW and swept modes. Front and rear panel Panel Features are shown with illustrated descriptions. Operating Instructions provide a front panel frequency calibration procedure, configuration switch setting instructions, and crystal detector and power meter leveling instructions. Operator's Maintenance includes information on the Plug-in error codes, fuses, and service tags.

3-3. OPERATING CHARACTERISTICS

3-4 Bandswitching and Resolution

3-5. The following paragraphs describe the bandswitching and frequency resolution characteristics of the 83590A RF Plug-in.

3-6. The 83590A 2 to 20 GHz RF output is provided in three bands. When sweeping a range of frequencies larger than a single band, the switching between these bands is done automatically. Careful selection of sweep frequencies may avoid problems associated with bandswitching such as harmonics, sweep time, stability, or switching discontinuities. Figure 3-1 illustrates the bandswitching points in the sequential and single band sweep modes.

3-7. Two areas relating to frequency resolution must be considered: these are input resolution and displayed resolution. Input resolution refers to the number of bits (8 bits = 256 points) in the digital to analog converter (DAC) used to generate the tuning voltage for a particular mode of operation. Table 3-1 cross-references input resolution with each DAC used. Displayed frequency resolution refers to the number of digits shown on the 8350A FREQUENCY displays.

3-8. Figure 3-2 is a simplified block diagram of the frequency tuning circuits. The net tuning voltage results from the summation of the three DAC outputs. With this DAC configuration the START/STOP sweep mode is computed by the microprocessor into a center frequency and a ΔF sweep width. Therefore the operation of all sweeps are set with a center frequency and sweep width. The center frequency is specified by the center frequency (CF) DAC and the Vernier DAC, and the sweep width is determined by the ΔF DAC.

3-9. The CF DAC has 12 bits, hence 4096 points across any of the Plug-in frequency bands (including overrange). The analog output ranges from zero to ten volts, which is used to coarsely specify the center frequency output of the Plug-in. These parameters give the CF DAC a resolution of 0.024% (2.5mV) over the full band (including overrange).

3-10. Resolution of Center Frequency is enhanced by a summed voltage generated by an 8-bit (256 points) Vernier DAC. Vernier range is set to $\pm 0.05\%$ of bandwidth (including overrange). In multiband Plug-ins, total range of the vernier will vary with each band sweep. Vernier resolution is determined by dividing $\pm 0.05\%$ bandwidth by 256 points (128 points either side of CF). The voltage range of the total 256 points on the Vernier DAC is equal to four points on the 12-bit CF DAC (two points on either side of CF). This increases CF resolution from 0.024% (2.5mV) to 0.00038% (.04mV), and improves the relative accuracy of the CF by a similar factor.

NOTE

When the vernier is adjusted through its zero-point, the CF DAC is incremented or decremented by the total value of the vernier (2 points on the CF DAC). At this time the accuracy of the Center Frequency is again entirely dependent on the CF DAC, 0.005% of bandwidth.

3-11. The ΔF DAC has 10 bits (1024 points). The analog output from this DAC ranges from -5 to $+5$ volts to produce an even sweep on either side of the center frequency. The Δ resolution improves with narrower sweep widths. For broad

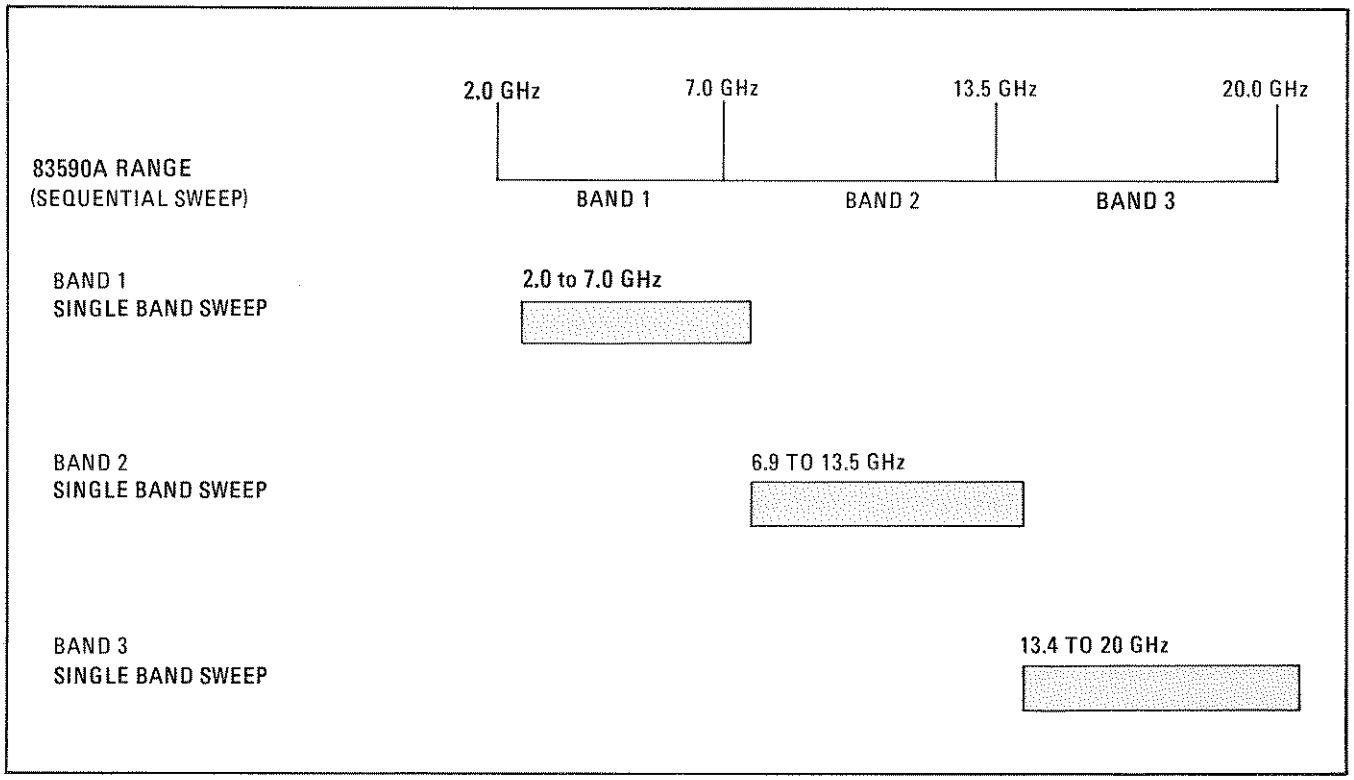


Figure 3-1. Bandswitching in Sequential and Single Band Sweep Modes

sweeps, the resolution is 0.1% of the full band. Greater resolution is provided for sweep widths less than 1/8 of the full band range. At these sweep widths, the resolution is improved to 0.012% of the full band.

3-12. Center Frequency is always displayed with 1 MHz resolution. Likewise, Vernier values are always displayed at 10 kHz resolution. Display resolutions for ΔF values vary with sweep width. Figure 3-3. illustrates the ΔF mode displayed resolution values versus displayed ΔF frequency sweep widths.

3-13. PANEL FEATURES

3-14. Front and rear panel features are described in Figure 3-4 and 3-5, respectively. Numbered callouts on the features described match numbered descriptions below each figure.

3-15. OPERATORS CHECKS

3-16. The Operator's Checks portion (Local and Remote) of the 8350A Sweep Oscillator manual provides a quick evaluation of both 8350A and 83590A main functions. Error codes 50 to 99, displayed on the 8350A FREQUENCY display, are reserved to indicate Plug-in related problems. The 8350A Local Check covers the Sweep Oscillator and RF Plug-in. If the correct indications are not obtained, trouble may be in either of the units. If the RF Plug-in is suspected, follow the troubleshooting information in Section VIII, Service, in this manual, to isolate the problem.

3-17. OPERATING INSTRUCTIONS

3-18. Peaking RF Output Power

3-19. Due to normal "aging" of the 83590A, it may be necessary to peak the RF output power to obtain the specified maximum leveled power. The front panel PEAK function is accessed by pressing SHIFT PEAK . In order to monitor the effect of the Peaking function on the RF Output, the 83590A must be set for an unleveled power condition. This can be accomplished by setting the ALC MODE to External (without an external detector) or increasing the Power setting until the RF output is unleveled. With the Peak function selected and an unleveled RF output, the POWER control should be adjusted to maximize the RF output power over the entire frequency range.

3-20. Internal Leveling

3-21. The most convenient method of RF output leveling is internal leveling. A portion of the RF output is coupled out of an internal directional detector, producing a dc voltage proportional to

Table 3-1. Input Resolution

DAC Used	Voltage Resolution	Frequency Resolution			
		Band 1 2.0 to 7.0 GHz	Band 2 7.0 to 13.5 GHz	Band 3 13.5 to 20 GHz	Full Sweep 2 to 20 GHz
CF	2.5 mV	1.17 MHz	1.65 MHz	1.65 MHz	5.08 MHz
Vernier	40 μV	18.25 kHz	25.78 kHz	25.78 kHz	79.38 kHz
ΔF 1–1/8 of band	10 mV	4.67 MHz	6.60 MHz	6.60 MHz	20.30 MHz
ΔF 1/8–1/64 of band	1.25 mV	.584 MHz	.825 MHz	.825 MHz	2.54 MHz
ΔF $\leq$1/64 of band	0.156 mV	73.0 kHz	103.2 kHz	103.2 kHz	317.2 kHz

the RF output signal. This detected dc voltage is applied to the ALC circuit.

3-22. External Crystal Detector Leveling

3-23. RF output power may also be leveled externally using a power splitter (or external directional coupler) and a negative output crystal detector. This leveling system uses a power splitter to sample a portion of the RF output signal with a crystal detector to produce a dc voltage proportional to the RF output power level. The detector output voltage is compared with an internal reference voltage, and the difference voltage changes the output power level to keep a constant RF output power level. A directional coupler may be used instead of a power splitter to sample the RF signal for the leveling loop. Directional couplers are usually narrow band devices, whereas the power splitter has a flatter frequency response over a wide frequency range. The advantage of a directional coupler is that it does not have as great a coupled loss as the 6 dB loss encountered with the power splitter, therefore, a higher maximum leveled power output may be obtained. Figure 3-6 illustrates a typical crystal detector leveling setup.

3-24. External Power Meter Leveling

3-25. RF output power may also be leveled with a power meter and power splitter (or directional coupler) as shown in Figure 3-7. The sweep time is limited to greater than 100 seconds when this leveling method is used. A sample of the RF output signal is routed to a power meter which produces a dc output voltage proportional to the RF input signal level. This dc voltage is applied to the 83590A ALC circuits and compared with an internal reference voltage. A difference voltage is produced and amplified by the ALC amplifier before being applied, as modulator drive, to a PIN Modulator.

3-26. External FM

3-27. The 83590A RF output signal can be frequency modulated using an external modulating signal applied to the 8350A rear panel FM INPUT connector. The external FM function provides a means of obtaining an output frequency that varies under the control of an external modulating signal. A positive-going voltage at the FM INPUT causes output frequency to decrease, while a negative-going voltage causes output frequency to increase. The sensitivity and coupling of the modulating signal may be set via configuration switch (A3S1). Figure 3-9 lists the available configuration switch settings. The configuration switch settings override 8350A Sweep Oscillator non-volatile memory settings at Instrument Preset.

3-28. External Amplitude Modulation

3-29. Pulse Modulation (PULSE IN Connector on Plug-in). The PULSE IN connector provides pulsed or square wave modulation, where the RF output is switched on and off. This input provides an on/off power ratio of greater than 30 dB below specified maximum leveled power. The PULSE IN input is normally at a TTL HIGH (approximately +3 volts dc). When a TTL LOW signal (approximately 0 volts dc) is applied, the RF output is turned off. To get the best pulse modulation performance, the RF output power should be set at +20 dBm. With this power setting, a pulse repetition rate of up to 1 MHz is achievable in the 2 to 7.0 GHz frequency bands. With leveled power in this frequency range, pulse repetition rates may be up to 100 kHz. In the 7.0 to 20.0 GHz frequency bands, RF power may be square-wave modulated at repetition rates up to

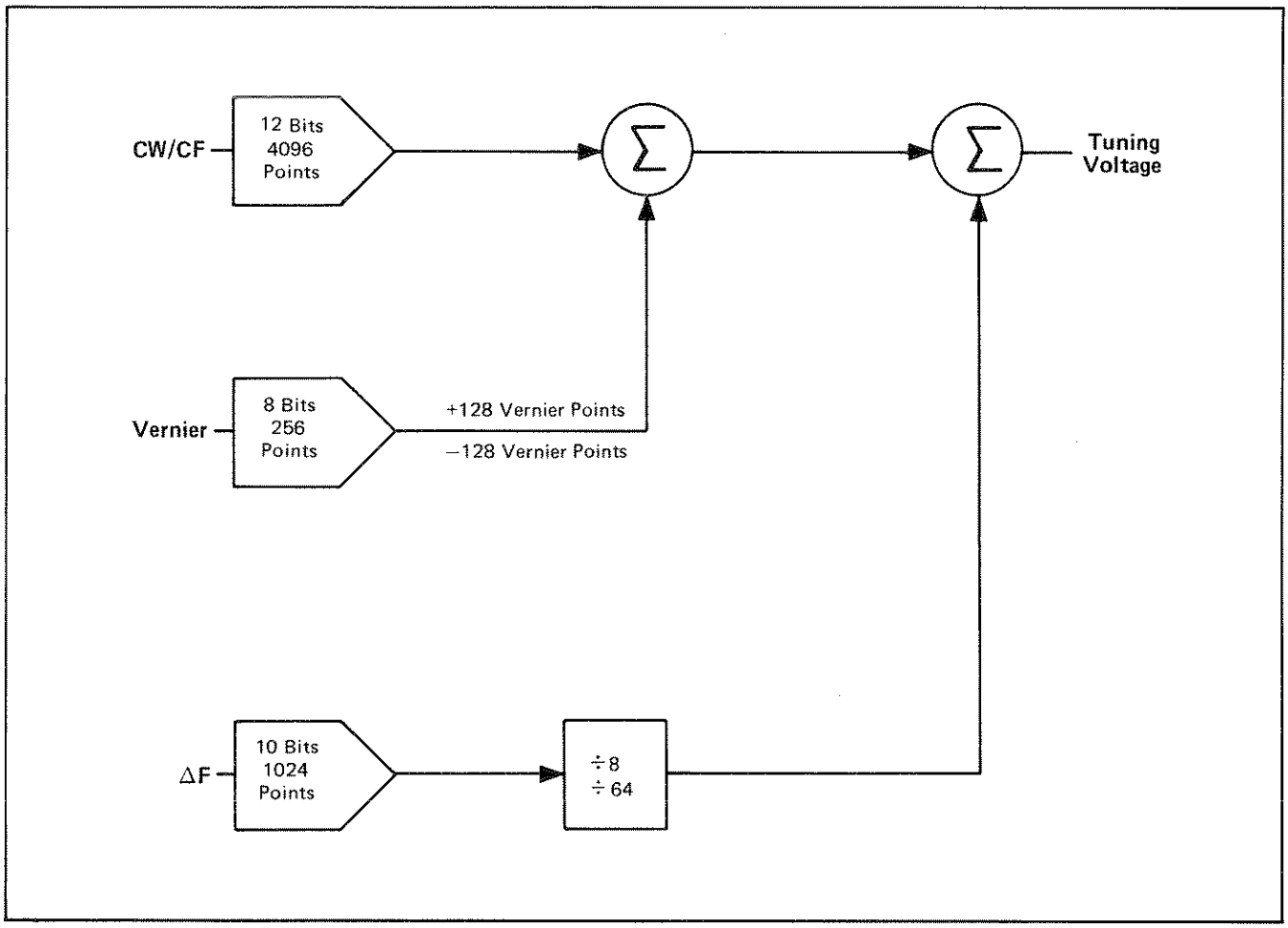


Figure 3-2. Simplified Tuning Voltage Block Diagram

ΔF Display Frequency Width

	0 MHz – 124 MHz	124 MHz – 1 GHz	1 GHz – 4.2 GHz	4.2 GHz – 20.0 GHz
Displayed Resolution	100 kHz	1 MHz	1 MHz	10 MHz
ΔF Display Indication	000.0 MHz	0000. MHz	0000. MHz	00.00 GHz

Figure 3-3. Delta F Sweep Mode Displayed Resolution

30 kHz at any power output setting. The input impedance for TTL level signals is approximately 500 ohms. If the PULSE IN circuit is driven beyond TTL levels, the input impedance is reduced to approximately 200 ohms due to the diode clamping action. See the specifications and supplemental characteristics in Section I for more details on the modulation characteristics when using this input.

3-30. Amplitude Modulation (AM INPUT Connector on 8350A). The AM INPUT provides linear amplitude changes (up to approximately15 dB) proportional to the modulating input voltage. It is limited to a frequency response of about 100 kHz. For maximum depth of modulation (i.e. maximum modulation index), the RF power level should be set to the middle of the control range (e.g. +2.5 dBm for a Plug-in with calibrated power control from −5 to +10 dBm). For Plug-ins equipped with Option 002 (70 dB step attenuator), the middle of the attenuator range should be selected. The center of the power control range may be selected with the front panel power control or by applying a dc bias voltage on the external modulating signal. A positive (+) dc voltage into the AM INPUT causes a decrease in RF output power; a negative (−) dc voltage causes an increase in RF output power.

3-31. RF Power Control

3-32. The RF power set at power-up (during Instrument Preset) may be either maximum power (+10 dBm) or RF power OFF as selected by the configuration switch (A3S1). Refer to Figure 3-9 for this setting. Configuration switch settings relating to the specific model Plug-in used and Option 002 Step Attenuator equipped instruments must be set prior to operation. Configuration switch number 7 is set at the factory and should not be changed.

3-33. Option 002 Step Attenuator

3-34. With Option 002 installed, the RF output power may be continuously controlled from +10 dBm to −75 dBm. When the selected POWER setting goes below −5 dBm, the step attenuator increments as required in 10 dB steps to a maximum attenuation of 70 dB. Within the individual 10 dB steps of the attenuator, the ALC loop adjusts the power output to the power level programmed by the front panel POWER control. Pressing SHIFT POWER SWEEP allows control of power within the ALC range without changing attenuator settings. The display in the SHIFT POWER SWEEP mode disregards attenuator settings and only displays the ALC setting. Pressing SHIFT SLOPE allows control of attenuator steps without affecting ALC setting. In this mode the attenuator setting is displayed.

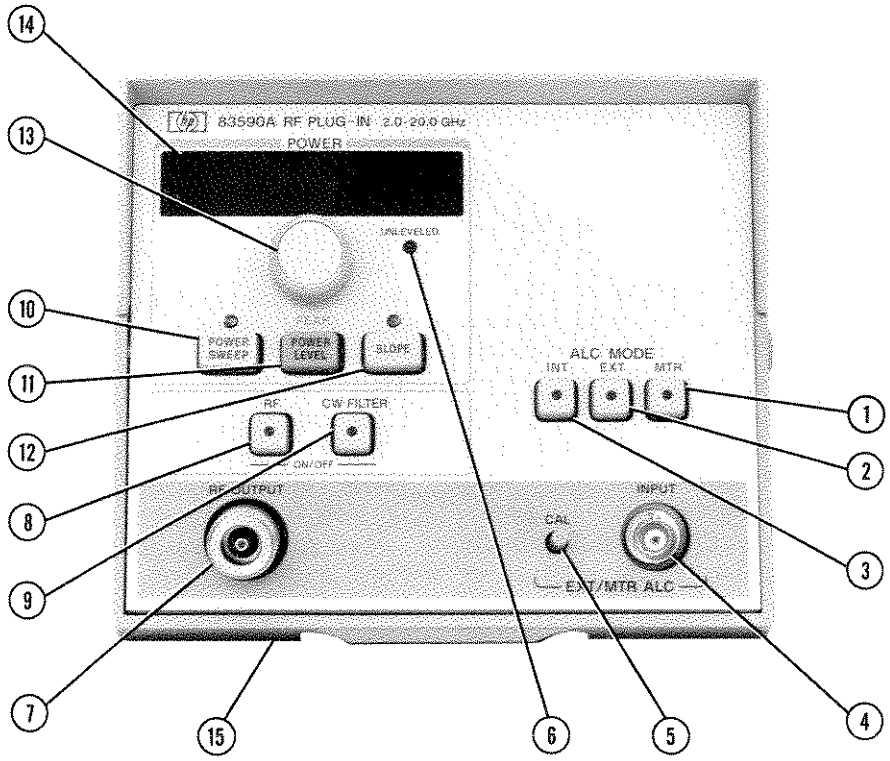
3-35. Alternate Sweep Mode

3-36. If the 83590A changes frequency bands (e.g. Band 1 to Band 3) between each sweep, the minimum sweep time recommended is 100 milliseconds. This allows enough time for the bandswitch operation and settling time for the fundamental oscillator for the next sweep.

3-37. If Option 002 attenuator is installed, and alternate sweep mode is selected, a slow sweep default condition of 1 second/sweep may occur. This default condition only occurs when the POWER settings of the two alternate sweeps require the attenuator to switch after each sweep. The attenuator is prevented from switching faster than 1 step per second to prevent damage to the attenuator relay coils due to overheating.

3-38. Phase-Lock Operation

3-39. The 83590A RF Plug-in RF output (CW) signal may be phase-locked to an external reference oscillator by using an external phase-lock signal applied to the 8350A rear panel FM INPUT connector. The phase-lock function provides a means of obtaining a very stable CW frequency by transferring the frequency stability of the reference oscillator to the 8350A Sweep Oscillator. If the CW frequency starts to drift, the phase difference between the CW frequency and the reference frequency (reference oscillator) is detected, producing a dc voltage. The dc voltage is returned to the FM INPUT as a correction signal which restores the CW frequency to its previous point. Stability of the RF output CW frequency is thus determined by the stability of the reference oscillator. The 83590A CW frequency used for phase-locking may be either the RF output or the fundamental oscillator frequency available at the rear panel AUX OUTPUT. Configuration switch (A3S1) switch position 8 must be set for the source of the CW frequency used for phase-locking (Figure 3-9). The CW filter should be turned off in phase lock operation. Although the front panel RF output can be used for phase-locking, this would require a broadband coupling device and a harmonic mixer capable of producing acceptable harmonic content up to 20 GHz. Therefore, it is preferable to use the rear panel AUX OUTPUT for phase-locking. See Figure 3-8.



FRONT PANEL FEATURES

1. Power meter automatic leveling control selection (HP 432 only).
2. External (crystal detector) automatic leveling control selection (negative crystal output).
3. Internal leveling control selection.
4. Connector (BNC) for power meter or external crystal leveling inputs (rear panel on Option 004).
5. Power level CAL adjust, for setting external (MTR or EXT) ALC.
6. UNLEVELED lamp lights if output power is unleveled.
7. Type-N 50-ohm RF output connector (rear panelon Option 004, APC-7 connector for option 005).
8. RF on-off key. Used for zeroing a power meter or referencing an X-Y recorder.
9. CW FILTER enables an oscillator tune voltage filter when in CW mode.
10. POWER SWEEP allows setting an increase in power per sweep (db/SWP). SHIFT POWER SWEEP allows control of power within the ALC range without changing attenuator settings (display reads ALC settings).
11. POWER LEVEL allows setting of output power for all ALC modes (may be calibrated for external leveling). PEAK allows peaking of RF OUTPUT power (selected when SHIFT POWER LEVEL is pressed.)
12. SLOPE allows setting of the frequency slope compensation in dB/GHz (for lossy devices). SHIFT SLOPE allows control of attenuator steps without affecting ALC setting (display reads attenuator setting).
13. Power control knob for controling power sweep, power level, peak, or slope.
14. Plug-in display provides readout of selected power mode in dBm, dB/GHz, or dB/SWP to a tenth of a dB/dBm.
15. Plug-in latch handle is used to remove, install, and latch the RF Plug-in in the Sweep Oscillator.

Figure 3-4. Front Panel Features

for an example of phase-locking with the rear panel AUX Output.

3-40. OPERATOR'S MAINTENANCE

3-41. Plug-in Error Codes

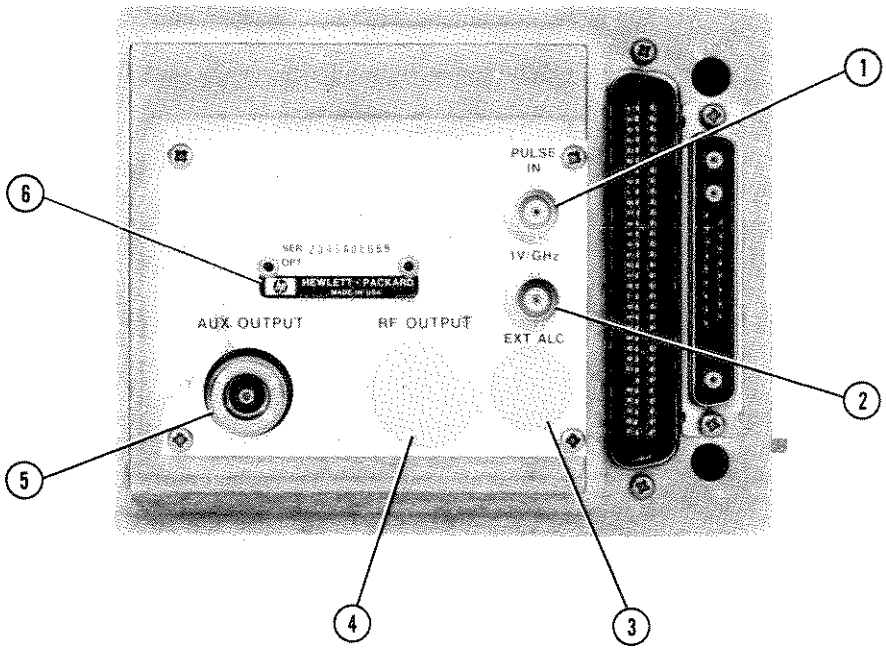
3-42. The 8350A FREQUENCY window will display RF Plug-in error codes (50 to 99) or Sweep Oscillator error codes. Information necessary to interpret Plug-in error codes may be found in Section VIII, Service, in this manual.

3-43. Fuses

3-44. Power circuits for the Model 83590A RF Plug-in are fused in the 8350A Sweep Oscillator. See the 8350A Sweep Oscillator Operating and Service Manual for fuse locations and replacement instructions.

3-45. Blue Service Tags

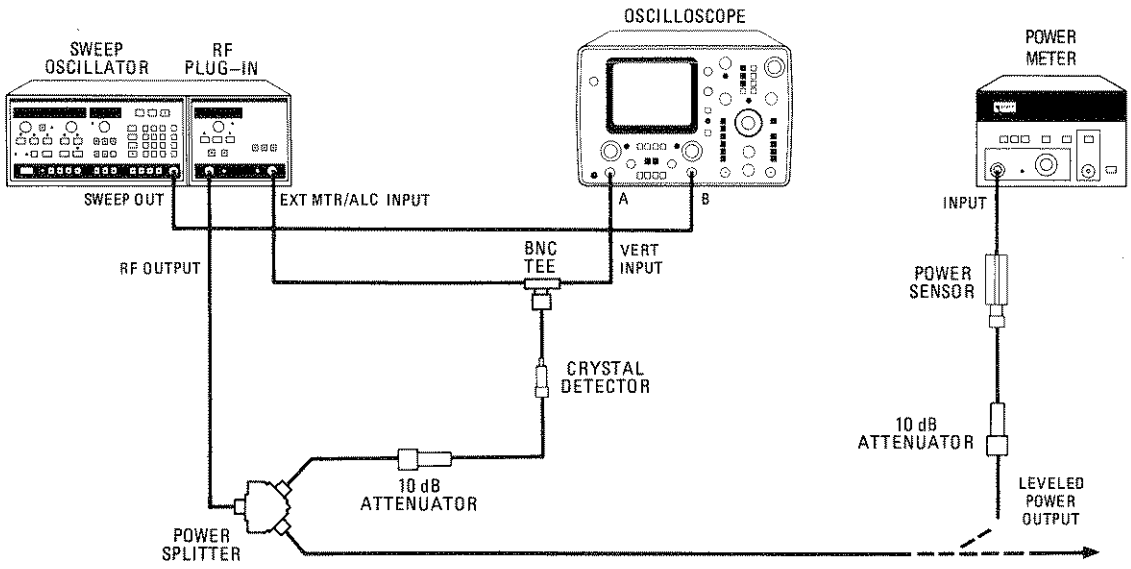
3-46. If the 83590A RF Plug-in requires service, the instrument may be sent to your local HP service organization as described in Section II, Installation, in this manual. Before sending the instrument back, fill out and attach one of the blue service tags. Record any error codes noted on the failure symptoms/special control settings portion of the tag.



REAR PANEL FEATURES

1. PULSE IN connector is used to input external pulse or squarewave modulation.
2. 1V/GHz connector provides a frequency reference output of approximately 1 volt dc per GHz.
3. EXT ALC connector replaces front panel EXT ALC connector on Option 004 Plug-ins.
4. RF OUTPUT connector replaces front panel RF output connector in Option 004 Plug-ins.
5. AUX OUTPUT connector provides 2.0 to 7.0 GHz fundamental oscillator output at approximately 0 dBm.
6. Serial Number Plate has a ten digit serial number (used in any correspondence concerning Plug-in) and Option number if applicable.

Figure 3-5. Rear Panel Features



EXTERNAL CRYSTAL DETECTOR LEVELING

EQUIPMENT:

Sweep Oscillator	HP 8350A
RF Plug-in	HP 83590A
Oscilloscope	HP 1740A
Power Meter	HP 436A
Power Sensor	HP 8485A
Crystal Detector	HP 8473C
Power Splitter	HP 11667A
10 dB Attenuator (2 required)	HP 8491B, Option 010
BNC Tee	HP 1250-0781

PROCEDURE:

NOTE

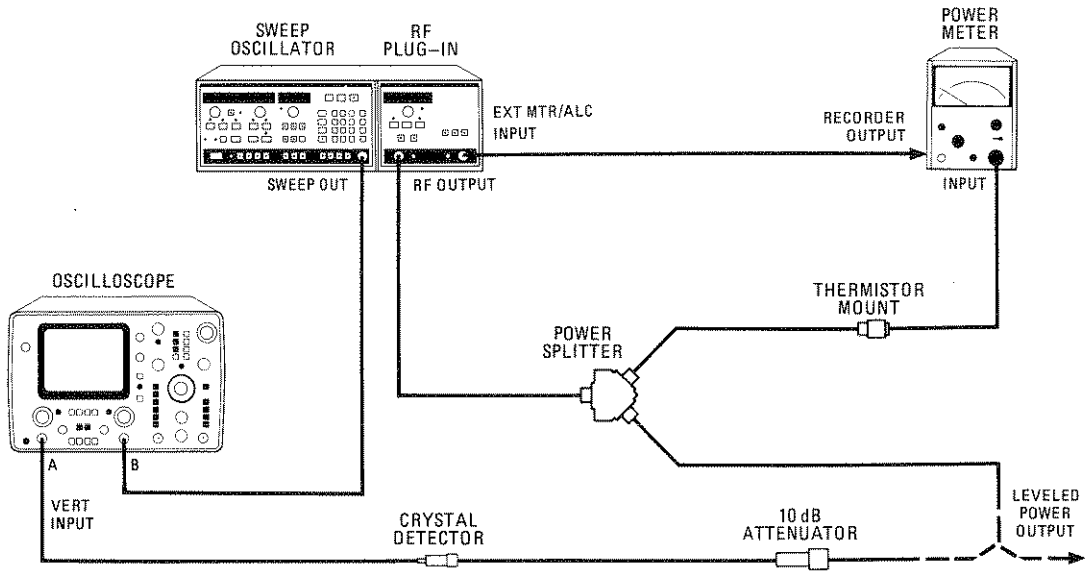
Crystal output signal must be between −10 mVdc and −200 mVdc.

1. Connect equipment as shown in test setup.
2. Switch on 8350A LINE switch. Press INSTR PRESET key. The START and STOP indicators should be on.
3. Set controls as follows:

   83590A:

   ALC MODE ..... EXT
4. Adjust EXT/MTR ALC CAL for a power meter reading equal to the front panel output power.
5. To use leveled RF power output for testing external equipment, make connection between power splitter and 10 dB attenuator.

Figure 3-6. External Crystal Detector Leveling



EXTERNAL POWER METER LEVELING

EQUIPMENT:

Sweep Oscillator	HP 8350A
RF Plug-in	HP 83590A
Power Meter	HP 432A
Thermistor Mount	HP 8478A
Oscilloscope	HP 1740A
Crystal Detector	HP 8473C
10 dB Attenuator	HP 8491B, Option 010
Power Splitter	HP 11667A

NOTE

For power meter leveling, sweep rates should be slower than 100 sec/sweep to ensure proper leveling due to the slow response of the thermistor mount. The HP 435 and 436 power meters will not power meter level this Plug-in. Only an HP 432 may be used.

PROCEDURE:

1. Connect equipment as shown in test setup.

2. Set LINE switch to turn on Sweep Oscillator. The START and STOP indicators should light, indicating the START/STOP mode is selected.

3. Set controls as follows:

   8350A: Press INSTR PRESET

SWEEP TIME	100 sec
START/STOP FREQUENCY	As required (<18 GHz for 8478A Thermistor Mount)

Figure 3-7. External Power Meter Leveling (1 of 2)

83590A: Set power to maximum specified.

ALC MODE..... MTR

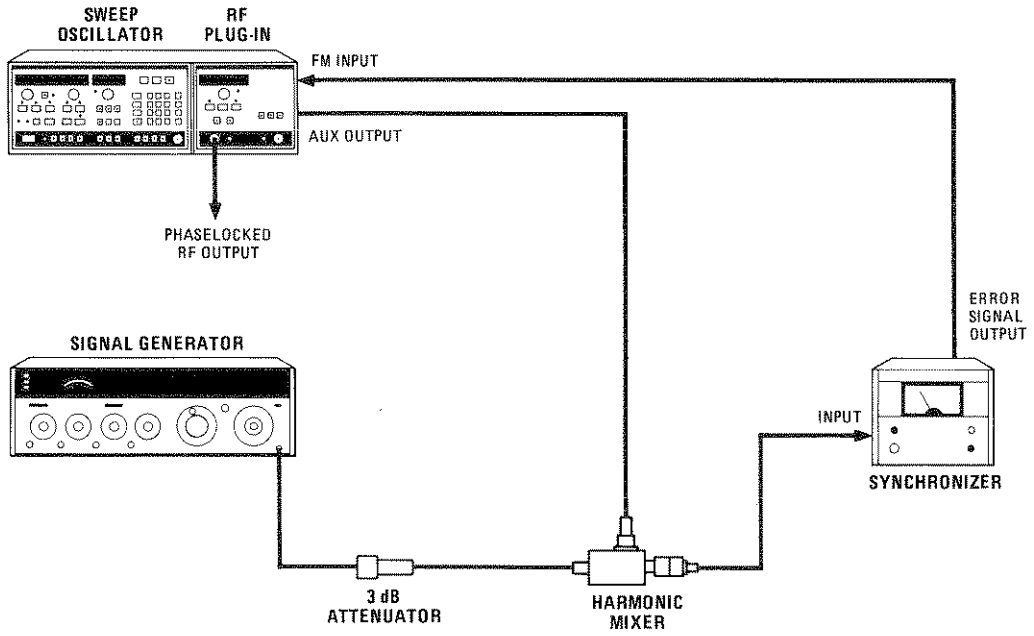
4. Select +10 dBm range on power meter.

5. Adjust 83590A EXT/MTR ALC CAL for a +7 dBm reading on the 432A power meter. Press 8350A SWEEP TRIGGER SINGLE key twice to set single sweep mode and start a sweep.

6. To use level RF power output for testing external equipment, make connection between power splitter and 10 dB attenuator.

Figure 3-7. External Power Meter Leveling (2 of 2)

PHASELOCKING WITH THE REAR PANEL AUX OUTPUT



EQUIPMENT:

Sweep Oscillator..... HP 8350A
RF Plug-in..... HP 83590A
Signal Generator..... HP 8640A Option 002
Synchronizer..... HP 8709A
Harmonic Mixer..... HP 934A
3 dB Attenuator..... HP 8491B, Option 003

Figure 3-8. Phaselocking with the Rear Panel Output (1 of 2)

PHASELOCKING WITH THE REAR PANEL AUX OUTPUT

PROCEDURE:

1. Set the 83590A Configuration Switch (A3S1) for an FM Sensitivity of −20 MHz/V, Direct Coupled FM, and AUX OUTPUT Phaselock (See Figure 3-9 for specific switch settings).

2. Connect equipment as shown in the test setup. On the 8350A press INSTR PRESET .

3. On the 8350A press CW and enter the desired CW frequency.

4. On the 83590A press CW FILTER to turn off the CW filter (pushbutton LED turned off). Set the 83590A Power Level between 0 and +5 dBm.

5. Set the 8640A for maximum RF output power (>+13 dBm) and both AM and FM Modulation turned off. Set the 8640A to the reference frequency (F_r) determined below.

   F_o = 83590A RF output frequency
   f_r = Reference frequency (8640A RF output frequency)
   N_1 = Harmonic Number of 83590A Fundamental Oscillator
   N_2 = Lowest integer that results in $F_r \leq 1024$ MHz

   For $F_o < 2.0$ GHz:

$$F_r = \frac{(F_o + 3.8\ \text{GHz}) - 20\ \text{MHz}}{N_2}$$

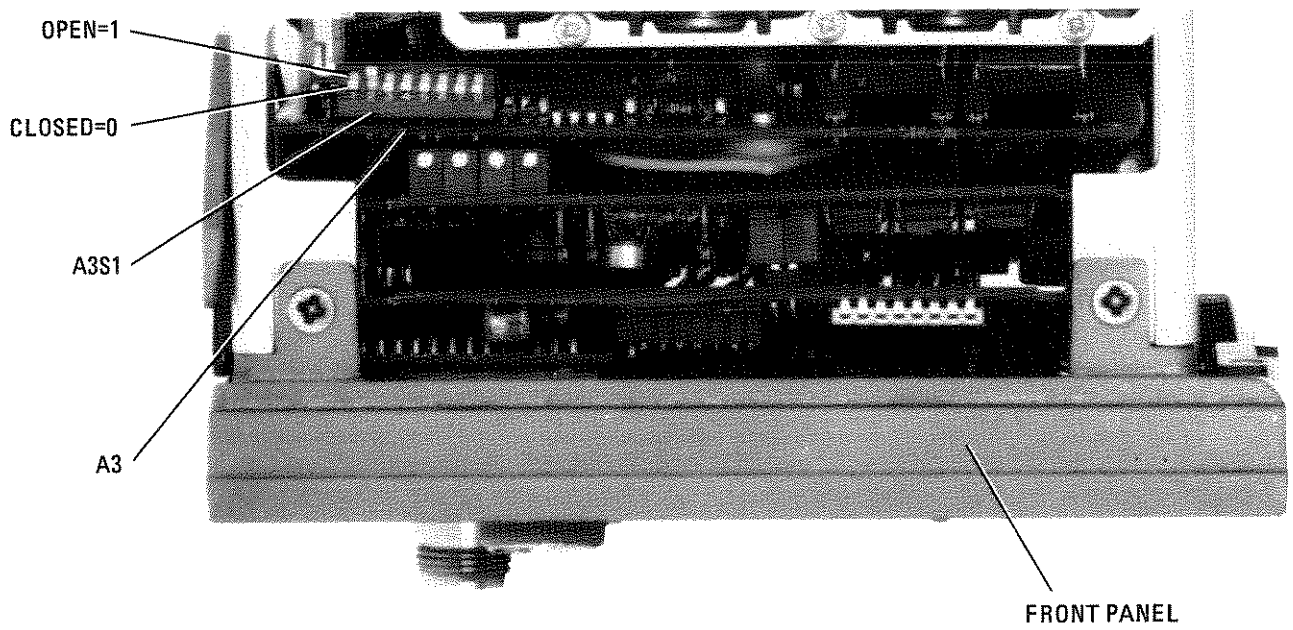
6. Tune the 8640A frequency to turn off the 8709A UNLOCKED light.

7. Slowly adjust the 8640A frequency for zero phase error indication on the 8709A.

8. The 83590A RF output is now phase-locked with the 8640A.

83590A CW Frequency			AUX OUT	N_2
Band 1 (GHz) (N_1=1)	Band 2 (GHz) (N_1=2)	Band 3 (GHz) (N_1=3)		
2.0 to 3.09	———	———	2.0 to 3.09	3
3.09 to 4.12	7.0 to 8.24	———	3.09 to 4.12	4
4.12 to 5.14	8.24 to 10.24	13.5 to 15.42	4.12 to 5.14	5
5.14 to 6.16	10.24 to 12.32	15.42 to 18.48	5.14 to 6.16	6
6.16 to 7.0	12.32 to 13.5	18.48 to 20.0	6.16 to 7.0	7

Figure 3-8. Phaselocking with the Rear Panel Output (2 of 2)



Description	Switch Number							
	1	2	3	4	5	6	7	8
Normal Sweep	0	X	X	X	X	X	X	X
Sequential Sweep Only	1	X	X	X	X	X	X	X
No RF Power at Instrument Preset	X	X	X	1	X	X	X	X
Maximum RF Power at Instrument Preset	X	X	X	0	X	X	X	X
–6 MHz/V FM Sensitivity	X	X	X	X	1	X	X	X
–20 MHz/V FM Sensitivity	X	X	X	X	0	X	X	X
Direct-Coupled FM (–20 MHz/V)	X	X	X	X	X	1	X	X
Cross-Over Coupled FM	X	X	X	X	X	0	X	X
Step Attenuator Option 002 Installed	X	X	X	X	X	X	1	X
No Step Attenuator	X	X	X	X	X	X	0	X
AUX OUT Phase Lock	X	X	X	X	X	X	X	1
RF OUTPUT Phase Lock	X	X	X	X	X	X	X	0

NOTES

1. Switch Positions:

   1 = Switch Open = High
   0 = Switch Closed = Low (Ground)
   X = Don't Care
   * = Varies, 1 if Opt. 002, 0 if no Opt. 002.

2. Switch is set at the factory as follows:

Switch No.	1	2	3	4	5	6	7	8
Position	0	X	X	0	0	0	*	0

Figure 3-9. Configuration Switch

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. The procedures in this section test the electrical performance of the 83590A RF Plug-in/8350A Sweep Oscillator combination with the specifications of the Plug-in used as the performance standards. These specifications may be found in Section I of this manual. Due to the extended frequency range of the 83590A, the performance tests in the 8350A Operating and Service Manual do not apply. None of the tests require access to the interior of the 83590A RF Plug-in.

NOTE

Allow the 83590A RF Plug-in and 8350A Sweep Oscillator to warm up for one hour prior to doing any performance tests.

4-3. EQUIPMENT REQUIRED

4-4. Equipment required to test is listed in the Recommended Test Equipment table in Section I of this manual. Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended model.

4-5. OPERATION VERIFICATION

4-6. Operation Verification consists of performing the tests listed in paragraph 4-13 steps 1 to 11 and paragraph 4-14 steps 1 to 13. Operation Verification of the HP-IB functions may be verified by executing the program listed in Section IV of the 8350A Operating and Service Manual. These tests provide reasonable assurance that the Sweep Oscillator and Plug-in are functioning properly and should meet the needs of an incoming inspection (80% verification).

4-7. TEST RECORD

4-8. Table 4-16 provides a tabulated index of the performance tests, their acceptable limits, and a column for recording actual measurements.

4-9. TEST SEQUENCE

4-10. The performance tests should be performed in the order they occur.

4-11. CALIBRATION CYCLE

4-12. The performance tests in this section should be performed at intervals of six months or less for the 83590A.

PERFORMANCE TESTS

Table 4-1. Performance Test

Performance Test	83590A Adjustment	8350A Adjustment
4-13. Frequency Range and Accuracy		
CW Accuracy	5-14, 5-16, 5-17	5-19
Swept Frequency Accuracy	5-15 thru 5-19, 5-23	
Marker Accuracy	5-14 thru 5-19, 5-23	5-20
4-14. Output Amplitude		
Power Variations at Maximum Power	5-25 thru 5-28	
Power Level Accuracy	5-27	
Power Meter Leveling	5-29	
Power Sweep		
4-15. Frequency Stability		5-11
4-16. Residual FM		5-11
4-17. Spurious Signals		
Nonharmonics	5-21	
4-19. Residual AM	5-21, 5-28	5-11
4-20. External FM	5-30	
4-21. AM On/Off Ratio		
Square-wave Symmetry	5-28	

4-13. FREQUENCY RANGE AND ACCURACY TEST

SPECIFICATION:

Frequency Range: 2.0 to 20.0 GHz

Frequency Accuracy:

Bands (GHz)	2.0 to 7.0	7.0 to 13.5	13.5 to 20.0	2.0 to 20.0
CW Mode	±5 MHz	±10 MHz	±15 MHz	———
All Sweep Modes	±20 MHz	±25 MHz	±30 MHz	±50 MHz
Frequency Markers	±20 MHz ±0.5% of sweep width	±25 MHz ±0.5% of sweep width	±30 MHz ±0.5% of sweep width	±50 MHz ±0.5% of sweep width

4-13. FREQUENCY RANGE AND ACCURACY TEST (Cont'd)

DESCRIPTION:

A frequency counter is used to check frequency range and accuracy in the CW mode. The frequency counter is also used to check swept frequency accuracy and markers in the START/STOP mode.

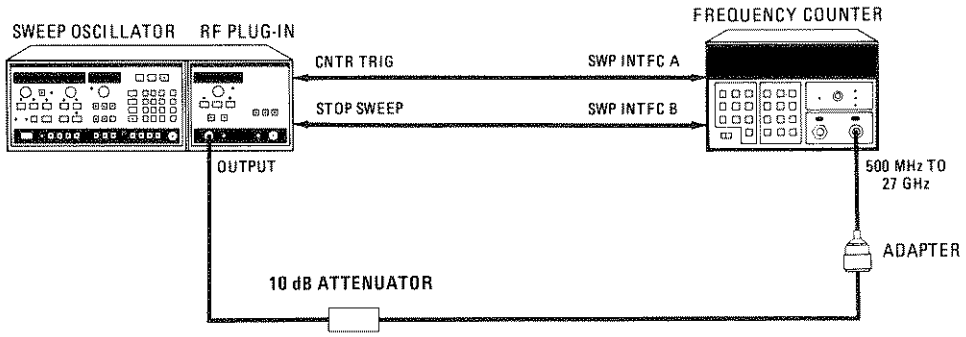


Figure 4-1. Frequency Range and CW Accuracy Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8350A
Frequency Counter	HP 5343A
10-dB Attenuator	HP 8491B, Option 010
Adapter, Type-N female to SMA female	1250-1404

PROCEDURE:

1. Connect equipment as shown in Figure 4-1.

2. Set controls as follows:

   Frequency Counter

LINE	ON
SAMPLE RATE	minimum (full CCW)
Range connector	500 MHz to 27 GHz
Impedance Switch	50Ω
ACQ TIME (rear panel)	FAST

3. Press 8350A INSTR PRESET. Note that the Sweep Oscillator display indicates a START frequency of 2 GHz and a STOP frequency of 20 GHz.

4-13. FREQUENCY RANGE AND ACCURACY TEST (Cont'd)

Frequency Range

4. Press 8350A CW key and enter a CW frequency of 2 GHz. If frequency observed on frequency counter is greater than 2 GHz rotate 8350A CW control counterclockwise until frequency on counter is at or below 2 GHz.

5. Enter a CW frequency of 20.0 GHz. If frequency observed on frequency counter is lower than 20.0 GHz rotate the 8350A CW control clockwise until the frequency counter reading is at or above 20.0 GHz.

CW Frequency Accuracy

6. Check CW frequency accuracy for each CW frequency listed in Table 4-2. Verify the frequency counter indication at the three points on each band is within the accuracy tolerance in Table 4-2. Follow the sequence of frequencies listed for each band from top to bottom to avoid band crossover problems.

Table 4-2. CW Frequency Accuracy

Bands (Accuracy)		
Band 1 (±5 MHz)	**Band 2 (±10 MHz)**	**Band 3 (±15 MHz)**
4.0 GHz	10 GHz	17.0 GHz
2.0 GHz	7.1 GHz	14.0 GHz
7.0 GHz	13.5 GHz	20.0 GHz

Swept Frequency Accuracy

7. Press frequency counter RESET, SWP M (Light on), Blue Key, 1KHz. Press 8350A INSTR PRESET and set sweep time to 105 msec.

8. Press the START and STOP frequencies on the 8350A for each band listed in Table 4-3.

9. Press 8350A START, SHIFT, then M2. Check the frequency counter reading for the START frequency listed in Table 4-3 and record on the test card.

10. Press 8350A STOP, SHIFT, then M2. Check the frequency counter reading for the STOP frequency listed in Table 4-3 and record on the test card.

11. Repeat steps 9 through 11 for each band listed.

4-13. FREQUENCY RANGE AND ACCURACY TEST (Cont'd)

Table 4-3. Swept Frequency Accuracy Table

Band	Start	Stop	Tolerance
Full Band	2.0 GHz	20.0 GHz	±50 MHz
Band 1	2.0 GHz	7.0 GHz	±20 MHz
Band 2	7.0 GHz	13.5 GHz	±25 MHz
Band 3	13.5 GHz	20.0 GHz	±30 MHz

Frequency Marker Accuracy

12. Press 8350A INSTR PRESET and set sweep time to 105 msec.

13. Set first band's START - STOP frequencies as listed in Table 4-4.

14. Set the 8350A markers to the frequency listed and verify that the frequency counter readings are within tolerance. Enter marker to be checked, then SHIFT M2 .

15. Set the START and STOP frequencies for each band listed and repeat the previous step with the markers set as listed.

Table 4-4. Frequency Marker Accuracy

Band	Sweep Range		Marker Frequencies					
	Start	Stop	M1	M2	M3	M4	M5	Tolerance
Full Band	2.0 to 20 GHz		3 GHz	6 GHz	10 GHz	14 GHz	18 GHz	±140 MHz
Band 1	2.0 to 7.0 GHz		3.0 GHz	6.0 GHz	———	———	———	±45 MHz
Band 2	7.0 to 13.5 GHz		8.0 GHz	12 GHz	———	———	———	±58 MHz
Band 3	13.5 to 20 GHz		15.0 GHz	18.0 GHz	———	———	———	±63 MHz

PERFORMANCE TESTS

4-14. OUTPUT AMPLITUDE TEST

SPECIFICATION:

	Frequency Bands (GHz)					
	2.0 to 7.0	**7.0 to 13.5**	**13.5 to 18.6**	**13.5 to 20.0**	**2.0 to 18.6**	**2.0 to 20.0**
Maximum Leveled Output Power [2, 3, 4] (25°C)	+10 dBm	+10 dBm	+10 dBm	+8 dBm	+10 dBm	+8 dBm
With Option 002	+8.5 dBm	+8 dBm	+7 dBm	+5 dBm	+7 dBm	+5 dBm
Power Level Accuracy[10] (Internally Leveled)	<±1.3 dB	<±1.3 dB	<±1.4 dB	<±1.4 dB	<±1.5 dB	<±1.5 dB
With Option 002[5] (at 0 dB attenuator step)	<±1.5 dB	<±1.5 dB	<±1.6 dB	<±1.6 dB	<±1.7 dB	<±1.7 dB

Minimum Settable Power: −5 dBm
With Option 002: −75 dBm

Power Variation (at specified Maximum Leveled Power or below)	Frequency Bands (GHz)			
	2.0 to 7.0	**7.0 to 13.5**	**13.5 to 20**	**2.0 to 20**
Internally Leveled	±0.7 dB	±0.7 dB	±0.8 dB	±0.9 dB
Externally Leveled Negative Crystal Detector [6] (Sweep time >100 ms)	±0.2 dB	±0.2 dB	±0.2 dB	±0.2 dB
Externally Leveled Power Meter[7]	±0.2 dB	±0.2 dB	±0.2 dB	±0.2 dB

DESCRIPTION:

A Power Meter is used to check power level accuracy, maximum leveled output power and power variations.

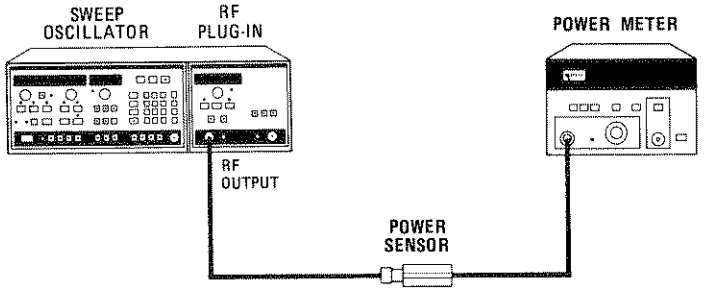


Figure 4-2. Output Amplitude Test Setup (Using HP 436A Power Meter)

PERFORMANCE TESTS

4-14. OUTPUT AMPLITUDE TEST (Cont'd)

EQUIPMENT:

Sweep Oscillator	HP 8350A
Power Meter	HP 436A
Power Sensor	HP 8485A
Power Meter	HP 432A
Thermistor Mount	HP 8478B
Thermistor Mount	HP K486A
Crystal Detector	HP 8473C
10 dB Attenuator	Weinschel Model 9-10
Power Splitter	Weinschel Model 1579A
Oscilloscope	HP 1740A
Adapter, Type N male to SMA female	HP 1250-1250
Adapter, Waveguide to SMA female	HP K281C
BNC TEE	HP 1250-0781

PROCEDURE:

1. Connect equipment as shown in Figure 4-2.

2. Press 8350A INSTR PRESET , set SWEEP to MAN.

Maximum Leveled Power and Power Variations

3. Set START and STOP frequencies and POWER LEVEL for the first frequency range listed in Table 4-5 (2.0 to 7.0 GHz at +10 dBm).

4. Slowly tune the 8350A FREQUENCY/TIME control and note the minimum power level in the band. Leave the frequency at this low power point.

5. Adjust 83590A POWER control for a power meter reading equal to the specified maximum leveled output power.

6. Slowly tune the 8350A FREQUENCY/TIME control through the frequency band. Note and record maximum power deviation on test record card.

7. Repeat steps 3 through 6 for the other frequency band settings listed in Table 4-5.

Table 4-5. Frequency and Power Settings

Frequency Range	Maximum Leveled Power		Power Sweep Range	
	(Standard)	(Option 002)	(Standard)	(Option 002)
2.0 to 7.0 GHz	+10 dBm	+8.5 dBm	15 dB/SWP	13.5 dB/SWP
7.0 to 13.5 GHz	+10 dBm	+8 dBm	15 dB/SWP	13 dB/SWP
13.5 to 18.6 GHz	+10 dBm	+7 dBm	15 dB/SWP	12 dB/SWP
13.5 to 20 GHz	+8 dBm	+5 dBm	13 dB/SWP	10 dB/SWP
2.0 to 18.6 GHz	+10 dBm	+7 dBm	15 dB/SWP	12 dB/SWP
2.0 to 20 GHz	+8 dBm	+5 dBm	13 dB/SWP	10 dB/SWP

4-14. OUTPUT AMPLITUDE TEST (Cont'd)

Power Level Accuracy, Range and Power Sweep

8. Set START and STOP frequencies and POWER LEVEL for the first frequency band in Table 4-5 (2.0 to 7.0 GHz at +10 dBm). Engage the 83590A POWER SWEEP, set the dB/SWP level to 16dB/SWP. Disengage POWER SWEEP key.

9. Slowly tune the 8350A FREQUENCY/TIME control through the frequency band and note the maximum power level variations above and below the displayed power level setting. Record these on the test record.

10. Press 83590A POWER LEVEL key. Use the 8350A ▼ key to step the power down 1 dB.

11. Repeat steps 9 and 10 to check power level accuracy over the full calibrated range (down to −5 dBm).

12. Adjust the FREQUENCY/TIME control for highest frequency and note power meter level. Engage POWER SWEEP and set it for maximum leveled power (UNLEVELED light off). Record power meter level change on test record.

13. Repeat steps 8 through 12 for the frequencies and power levels listed in Table 4-5.

Power Meter Leveling

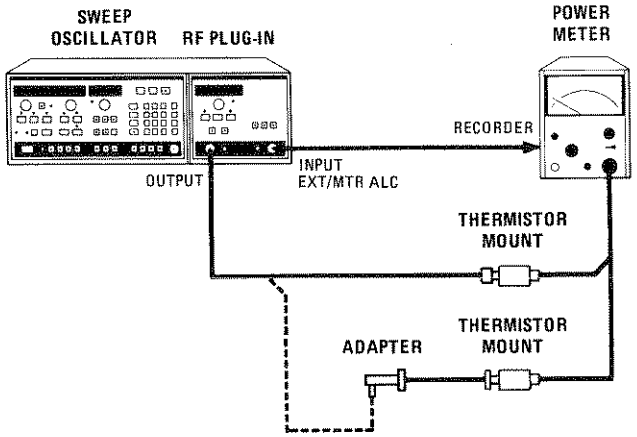


Figure 4-3. Power Meter Leveling Test Setup (Using HP 432A Power Meter)

14. Connect equipment as shown in Figure 4-3 using HP 8478B Thermistor Mount.

15. Press 8350A INSTR PRESET, set STOP frequency to 18 GHz. Set SWEEP TIME to 100 seconds and SWEEP TRIGGER to SINGLE.

16. Adjust ALC EXT/MRT CAL control and power meter range switch for a power meter indication corresponding to the 83590A POWER display.

17. Press SWEEP TRIGGER SINGLE key and note power meter variations.

4-14. OUTPUT AMPLITUDE TEST (Cont'd)

18. When SWP light goes out, press 8350A CW and set a CW frequency of 18 GHz. Note the power meter indication.

19. Change to the K486A Thermistor Mount and adjust the ALC EXT/MTR CAL control for the same power meter indication noted in step 17.

20. Set the Sweep Oscillator for a START/STOP frequency of 18 to 20 GHz and a SWEEP TIME of 10 seconds.

21. Press SWEEP TRIGGER SINGLE key and note power variations. The combined variations from step 16 and 20 should be $\leq \pm 0.2$ dB.

External Crystal Detector Leveling

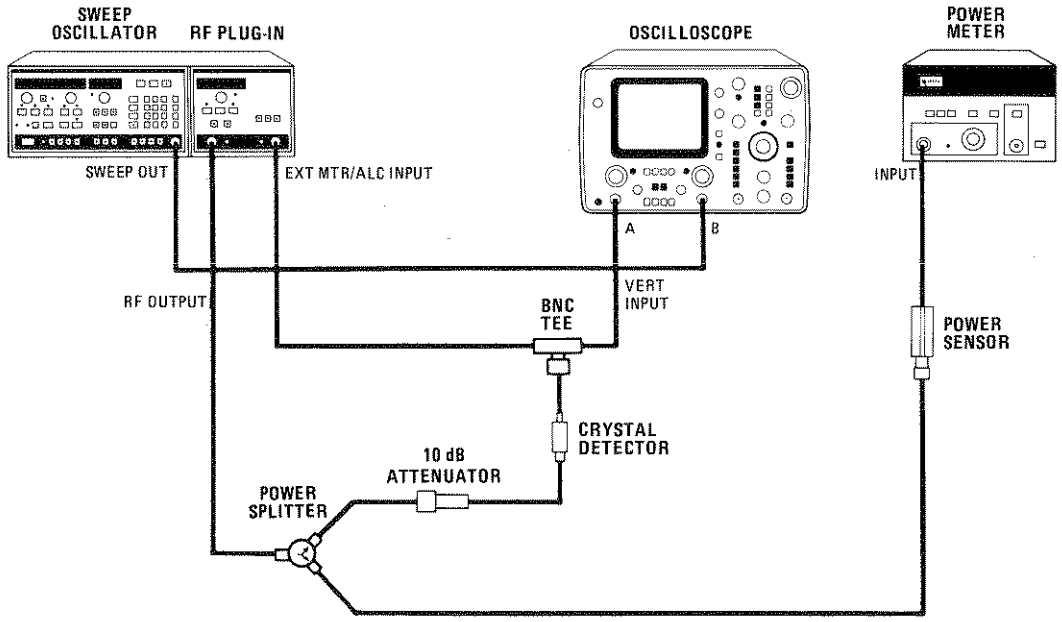


Figure 4-4. Crystal Detector Leveling Test Setup (Using HP 436A Power Meter)

22. Connect equipment as shown in Figure 4-4. Press 8350A INSTR PRESET and set SWEEP TIME to 100 milliseconds. Set the oscilloscope for external sweep mode (A vs B).

23. Press 8350A CW . Adjust the oscilloscope to the center graticule. Adjust the 83590A POWER LEVEL to decrease the power meter indication by 0.4 dB. Note the new trace position on the oscilloscope: the area between the trace and the center graticule represents the leveling tolerance of ± 0.2 dB.

24. Press 8350A START .

25. Adjust the oscilloscope trace position so that the lowest point of the trace is on the center graticule. The highest point of the trace should be within the leveled variation limits established in step 22.

4-15. FREQUENCY STABILITY TEST

SPECIFICATION:

Stability	Frequency Bands (GHz)			
	2.0 to 7.0	7.0 to 13.5	13.5 to 20.0	2.0 to 20.0
With 10% Line Voltage Change	±50 kHz	±100 kHz	±150 kHz	±150 kHz
With 10 dB Power Level Change	±200 kHz	±400 kHz	±600 kHz	±600 kHz
With 3:1 Load SWR	±100 kHz	±200 kHz	±300 kHz	±300 kHz
With Time (in a 10 minute period after one hour warmup)	<±100 kHz	<±200 kHz	<±300 kHz	<±300 kHz

DESCRIPTION:

A frequency counter is used to check frequency change due to line voltage changes, time (10 minutes), output power level changes, and load impedance changes.

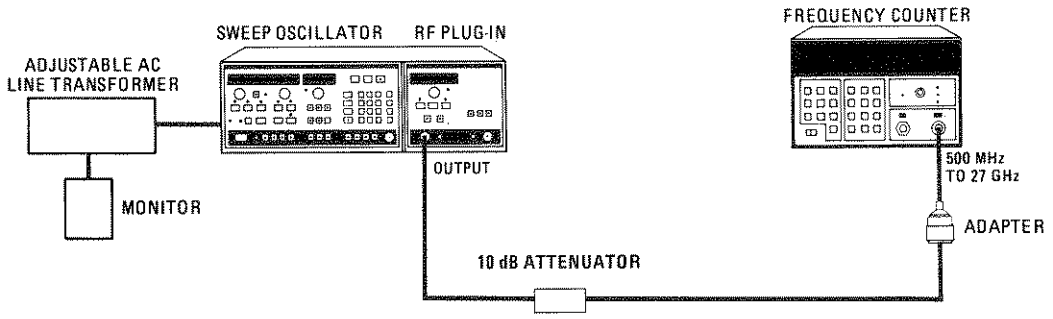


Figure 4-5. Frequency Change with Line Voltage Change

EQUIPMENT:

NOTE

More than one model number is listed for some test equipment. Use only the equipment needed to cover the line voltage used.

Sweep Oscillator ..... HP 8350A
Frequency Counter ..... HP 5343A
10 dB Attenuator ..... HP 8491B Option 010
3 dB Attenuator ..... HP 8491B Option 003
Adapter, Type-N, female to SMA female ..... HP 1250–1404

4-15. FREQUENCY STABILITY TEST (Cont'd)

Adjustable AC Line Transformer and monitor (Select for line voltage needed)
100-120 volt ..... General Radio W5MTB
120 V Monitor ..... RCA WV 120B
220-240 volt ..... General Radio W10HM73
240V Monitor ..... RCA WV 503A
3 dB Attenuator ..... Weinschel Model 9-3
Adjustable Short ..... Maury Microwave 1953-2

PROCEDURE:

Frequency Change with Line Voltage Change

1. Connect equipment as shown in Figure 4-5 and set 8350A LINE switch to ON.

2. Set adjustable line transformer using suitable monitor to the line voltage set on the 8350A power module. Press the 8350A INSTR PRESET and CW key and enter a CW frequency of 6.0 GHz. Rotate frequency counter SAMPLE RATE knob to HOLD, press SET , OFS MHz , Blue Key , then rotate the Frequency Counter SAMPLE RATE knob counter-clockwise back to the normal position.

Table 4-6. High and Low Line Voltage Selection Table

Nominal Line Voltage	100V	115/120V	220V	240V
Low Line Voltage	90V	108V	198V	216V
High Line Voltage	105V	126V	231V	252V

3. Set adjustable line transformer to the low line voltage using suitable monitor which corresponds to the selected nominal voltage in Table 4-6. Check and record on the test card step 3 the difference frequency displayed on counter.

4. Set adjustable line transformer using suitable monitor to the high line voltage using suitable monitor which corresponds to the selected nominal voltage. Check and record on the test record card step 4 the difference frequency displayed on counter.

5. Repeat steps 2 through 4 for the frequencies listed in Table 4-7.

Table 4-7. Frequency Change with Line Voltage Change

Band	CW Frequency	Frequency Change
Band 1	6.0 GHz	±50 kHz
Band 2	12.0 GHz	±100 kHz
Band 3	18 GHz	±150 kHz

4-15. FREQUENCY STABILITY TEST (Cont'd)

Frequency Change with Time (10 minutes)

6. Set adjustable line transformer voltage to nominal. Enter POWER LEVEL 1 0 dBm , then CW 6 GHz (wait one minute for frequency counter and Oscillator to settle).

7. Rotate the frequency counter SAMPLE RATE knob to HOLD, press SET , OFS MHZ , Blue Key , then rotate the Frequency Counter SAMPLE RATE knob counter-clockwise back to the normal position. The counter is now indicating frequency change with time. Wait 10 minutes while observing frequency count for maximum frequency change and record this maximum change on the performance test record card step 7.

8. Repeat steps 6 and 7 for the other frequencies shown in Table 4-8.

Table 4-8. Frequency Change with Time

Band	CW Frequency	Frequency Change
Band 1	6.0 GHz	±100 kHz
Band 2	12.0 GHz	±200 kHz
Band 3	18 GHz	±300 kHz

Frequency Change with 10 dB Power Level Change

9. Enter CW 6 GHz .

10. Rotate the frequency counter SAMPLE RATE knob to HOLD, press SET , OFFSET , Blue Key , then rotate the frequency counter SAMPLE RATE knob counter-clockwise back to the normal position. Enter POWER LEVEL 0 dBm . Verify the frequency change is less than given in Table 4-9.

11. Repeat steps 9 and 10 for the other frequencies given in Table 4-9.

Table 4-9. Frequency Change with Power Level Change

Band	CW Frequency	Frequency Change
Band 1	6.0 GHz	±200 kHz
Band 2	12.0 GHz	±400 kHz
Band 3	18 GHz	±600 kHz

4-15. FREQUENCY STABILITY TEST (Cont'd)

Frequency Change With 3:1 Load SWR

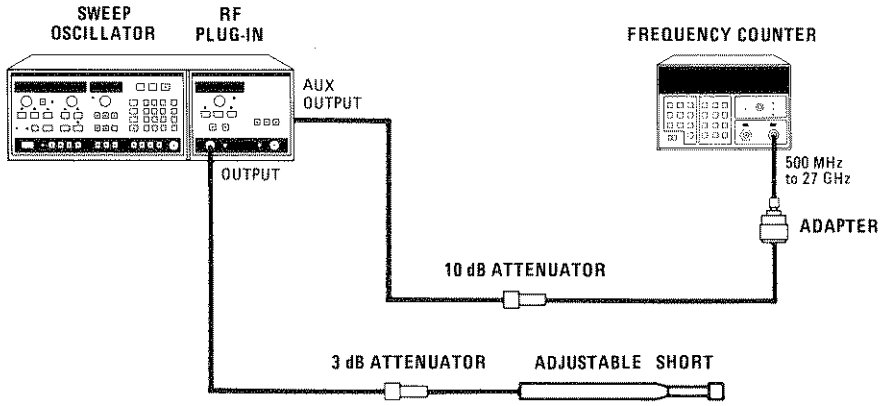


Figure 4-6. Frequency Change with 3:1 Load SWR Test Setup

12. Connect equipment as shown in Figure 4-6. Press the 8350A INSTR PRESET, CW 6 GHz, then POWER LEVEL 1 0 dBm.

13. Since the frequency of the AUX OUTPUT is being counted, a multiplication factor must be entered for bands 2 and 3 only to yield actual RF OUTPUT frequency errors. No factor is needed for band 1. In band 2 press SET, . (decimal point), 2, and ENTER on counter. In band 3, press SET, ., 3, and ENTER.

14. On counter rotate the SAMPLE RATE knob clockwise to HOLD, press SET, OFS MHZ, Blue Key, then rotate the SAMPLE RATE knob counter-clockwise to the normal position on the Frequency Counter.

15. Adjust the adjustable short through its range while observing the frequency counter for the greatest plus and minus frequency change. Check that the peak-to-peak frequency change is less than given in Table 4-10.

16. Enter the next CW frequency and repeat steps 14 and 15. To clear the counter multiplication factor, press SET, . and ENTER.

Table 4-10. Frequency Change with 3:1 Load SWR

Band	CW Frequency	Frequency Change
Band 1	6.0 GHz	±100 kHz
Band 2	12.0 GHz	±200 kHz
Band 3	18 GHz	±300 kHz

4-16. RESIDUAL FM TEST

SPECIFICATION:

10 Hz to 10 kHz Bandwidth, CW mode with CW Filter
2.0 to 7.0 GHz: <5 kHz (peak)
7.0 to 13.5 GHz: <7kHz (peak)
13.5 to 20 GHz: <9 kHz (peak)

DESCRIPTION:

The CW RF output signal is slope-detected by using the linear portion of a spectrum analyzer resolution bandwidth filter in the zero-span mode.

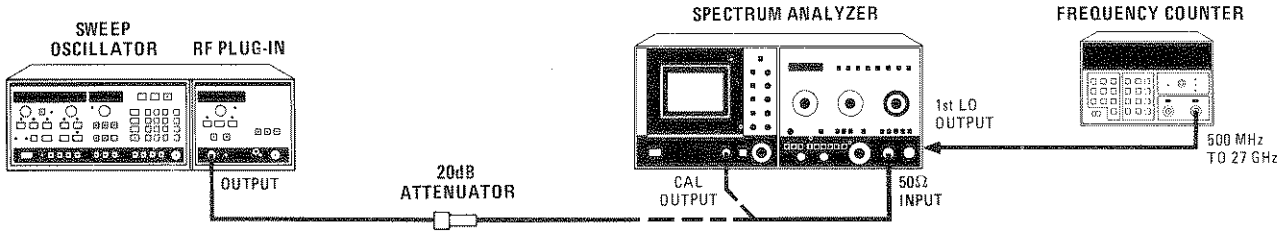


Figure 4-7. Residual FM Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8350A
Spectrum Analyzer	HP 8565A
Frequency Counter	HP 5343A
10 dB Attenuator	Weinschel Model 9-10

PROCEDURE:

1. Connect equipment as shown in Figure 4-7. Connect the spectrum analyzer CAL OUTPUT to the spectrum analyzer input.

2. Press 8350A INSTR PRESET , CW . Enter a CW frequency of 6.0 GHz.

NOTE

To mimimize drift, allow five minutes warmup before continuing with test.

4-16. RESIDUAL FM TEST (Cont'd)

3. Set spectrum analyzer controls as follows:

TUNING	0.100 GHz
FREQUENCY SPAN/DIV	.5 MHz
RESOLUTION BW	300 kHz (uncoupled)
INPUT ATTEN	−30 dB
REFERENCE LEVEL	−10 dBm
AMPLITUDE SCALE	LIN
AUTO STABILIZER	ON
SWEEP TIME/DIV	10 msec/DIV
SWEEP TRIGGER	FREE RUN
BASELINE CLIPPER	fully counterclockwise (OFF)
VIDEO FILTER	.01

4. Adjust spectrum analyzer TUNING to center the 100 MHz CAL OUTPUT signal on the spectrum analyzer display.

5. Adjust spectrum analyzer REFERENCE LEVEL controls to place the peak of the signal trace at the reference level (top) graticule line.

6. Reduce RESOLUTION BW to 100 kHz and FREQUENCY SPAN/DIV to 100 kHz while keeping the signal centered with the FINE TUNING control. The spectrum analyzer display should be as shown in Figure 4-8.

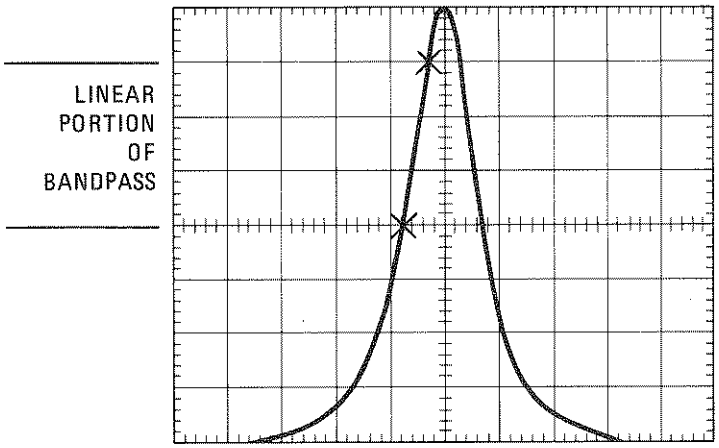


Figure 4-8. Spectrum Analyzer Display for Residual FM

7. Set the FREQUENCY SPAN MODE to ZERO SPAN and adjust the FINE TUNING control counterclockwise to position the CRT trace on the center horizontal graticule. Note the frequency counter indication: _____ kHz.

8. Adjust the FINE TUNING control clockwise to position the CRT trace on the seventh graticule (one division below the Reference Level). Be sure to stay tuned on the lower frequency side of the signal bandpass. Note the frequency counter indication: _____ kHz.

4-16. RESIDUAL FM TEST (Cont'd)

9. The spectrum analyzer demodulation sensitivity per division is calculated as one third of the difference frequency between the frequencies noted in steps 7 and 8. Calculate the demodulation sensitivity: _____ kHz/Div.

10. Connect the 8350A RF OUTPUT signal to the spectrum analyzer.

11. Set spectrum analyzer controls as follows:

TUNING ..... 6.00 GHz
FREQUENCY SPAN/DIV ..... .5 MHz
AMPLITUDE SCALE ..... LIN
REFERENCE LEVEL ..... +10 dBm

12. Adjust spectrum analyzer REFERENCE LEVEL controls to place the peak of the signal trace at the reference level (top) graticule line.

13. Reduce FREQUENCY SPAN/DIV to 0 while keeping the signal centered on the CRT with the FINE TUNING control.

15. Position the trace between the fifth and seventh graticules by turning the FINE TUNING control counterclockwise. STORE a single trace.

16. Note the maximum peak-to-peak deviation in divisions of the CRT trace. The peak deviation is one-half the peak-to-peak deviation. Multiply the peak deviation by the modulation sensitivity calculated in step 8.

Residual FM (kHz) = (peak-to-peak deviation/2) X (demodulation sensitivity)
=_____ kHz

17. Verify that residual FM is within tolerance given in Table 4-11.

18. Repeat steps 11 through 17 with spectrum analyzer and RF Plug-in tuned to each frequency listed in Table 4-11.

Table 4-11. Residual FM

Band	CW Frequency	Residual FM
Band 1	6.0 GHz	<8 kHz
Band 2	12.0 GHz	<15 kHz
Band 3	18.0 GHz	<15 kHz

PERFORMANCE TESTS

4-17. SPURIOUS SIGNALS TEST

SPECIFICATIONS:	Frequency Bands (GHz)			
	2.0 to 7.0	7.0 to 13.5	13.5 to 20	2.0 to 20
Harmonics (in dB below carrier)	>25 dB	>25 dB	>25 dB	>25 dB
Non-Harmonics	>50 dB	>50 dB	>50 dB	>50 dB

DESCRIPTION:

RF output signal from Sweep Oscillator is displayed on a spectrum analyzer to verify that harmonic and non-harmonic spurious signals are at or below the specified level.

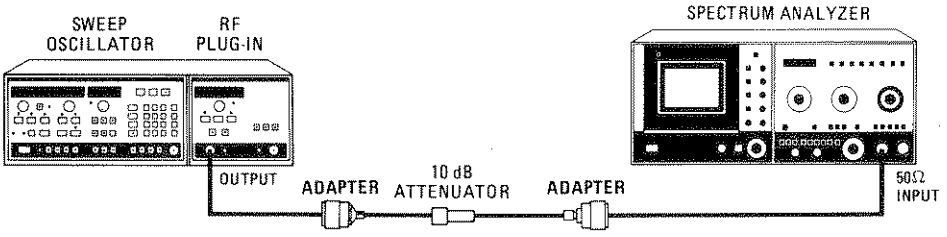


Figure 4-9. Spurious Signals Test Setup

EQUIPMENT:

Sweep Oscillator..... HP 8350A
Spectrum Analyzer..... HP 8565A
10 dB Attenuator..... Weinschel Model 9-10
Adapter, Type N male to SMA female..... HP 1250-1250
Adapter, Type N female to SMA female..... HP 1250-1562

PROCEDURE:

1. Connect equipment as shown in Figure 4-9.
2. Set controls as follows:

8565A:
Set all Normal Settings (controls marked with green)
FREQUENCY BAND GHz..... 1.7 to 4.1
INPUT ATTEN..... 10 dB
REF LEVEL dBm..... +10 dBm
FREQUENCY SPAN MODE..... FULL BAND

8350A
Press INSTR PRESET , CW , 2 GHz .

83590A
POWER..... Specified Maximum Leveled Power
CW FILTER..... ON

4-17. SPURIOUS SIGNALS TEST (Cont'd)

NOTE

The spectrum analyzer originates some mixing products that may appear on the display. If a signal is in question, increase the spectrum analyzer input attenuation by 10 dB, note if signal decreases in amplitude by 10 dB, then return the attenuator to the original position. If the signal in question comes from an external source, it will change by 10 dB. If the signal in question originates in the spectrum analyzer, the level will either change by greater or less than 10 dB or may not change at all.

The 8350A CW control when being rotated may generate some noise spikes. These signals should disappear when rotation is stopped.

If a spurious signal is found that appears out of specifications check the fundamental signal amplitude to ensure it is at maximum specified power. Then check spurious level by substituting a known amplitude signal on the spectrum analyzer.

3. Adjust the 8350A CW control through the entire frequency range of the RF Plug-in (2.0 to 20.0 GHz) and check for harmonic and non-harmonic spurious signals. The specifications for harmonic and non-harmonic signals are listed below.

Table 4-12. Spurious Signals Specifications

Frequency Band (83590A)	Harmonics dB below carrier	Nonharmonics dB below carrier
2.0 to 7.0 GHz	>25 dB	>50 dB
7.0 to 13.5 GHz	>25 dB	>50 dB
13.5 to 20 GHz	>25 dB	>50 dB

4-18. OUTPUT SWR TEST (INTERNALLY LEVELED)

SPECIFICATION:

Output SWR: <1.9
Option 002: <2.1

DESCRIPTION:

The RF Output signal is measured using a directional coupler, crystal detector, and oscilloscope. The signal at the oscilloscope contains (1) the incident signal from the oscillator, and (2) the reflected signal. The reflected signal is developed as follows: The incident signal travels down the 20 cm air lines, encounters the open end, and is reflected back to the source. If the reflected signal at the RF OUTPUT connector encounters a perfect 50-ohm source match, no signal is reflected back. However, the greater the mismatch, the greater the reflected signal. This reflected signal either adds to or subtracts from the incident signal. This variation is displayed on the oscilloscope.

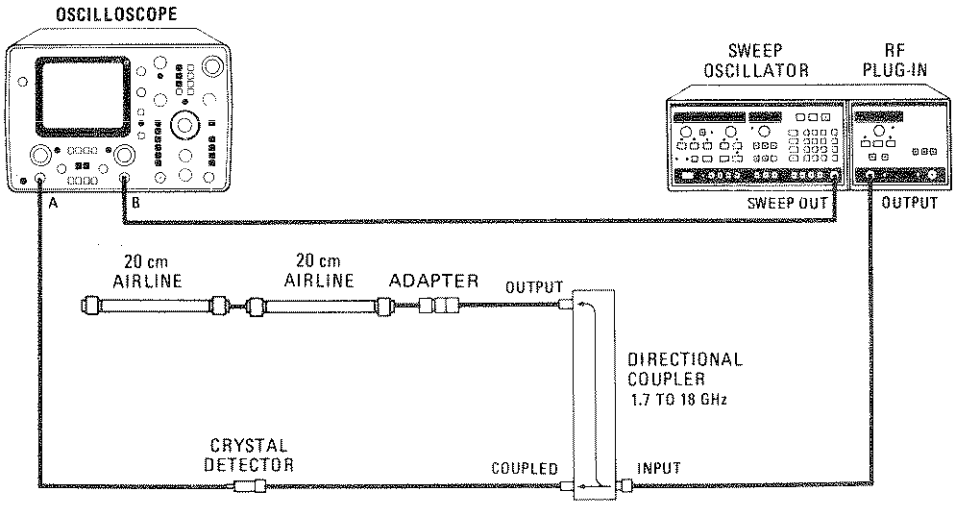


Figure 4-10. Output SWR Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8350A
Oscilloscope	Any general purpose oscilloscope such as HP 1222A or 1740A
Crystal Detector	HP 8470A Option 012
Directional coupler	HP 11691D
20-cm Air Lines (2 required)	HP 11567A
Adapter APC-7 to Type-N male	HP 11525AC

4-18. OUTPUT SWR TEST (Cont'd)

PROCEDURE:

1. Connect equipment as shown in Figure 4-10. Put oscilloscope in A vs. B mode, and adjust horizontal offset and Channel B sensitivity so the trace fills the screen.

2. Press INSTR PRESET , START , 2 , GHz , STOP 1 8 GHz on 8350A. Set DISPL BLANKING off and RF BLANKING on.

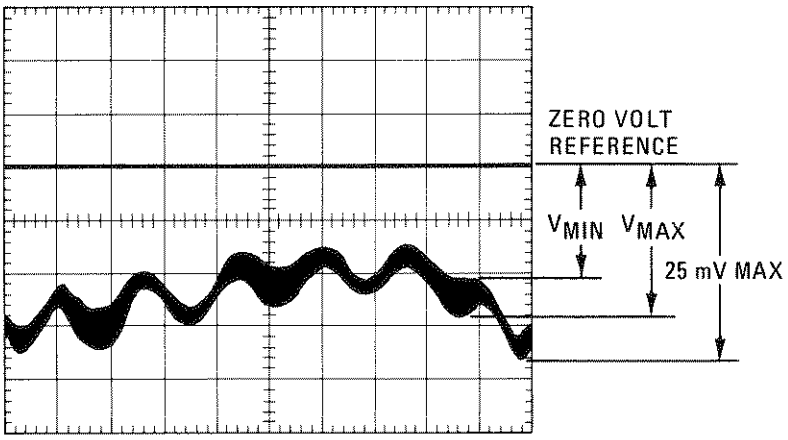


Figure 4-11. Typical Low Frequency Swept SWR Measurement

3. Adjust POWER control on Plug-in for a maximum output power of −25 millivolts peak trace on oscilloscope display in order to keep crystal in square law output range.

4. Select points on trace where V MAX/V MIN appear to have greatest separation and calculate V MAX/V MIN for each point (see Figure 4-11).

5. Convert greatest V MAX/V MIN ratio noted in step 10 into source match SWR using Figure 4-12 on the 0 dB loss line. The SWR should be less than 1.9 (2.1 for Option 002).

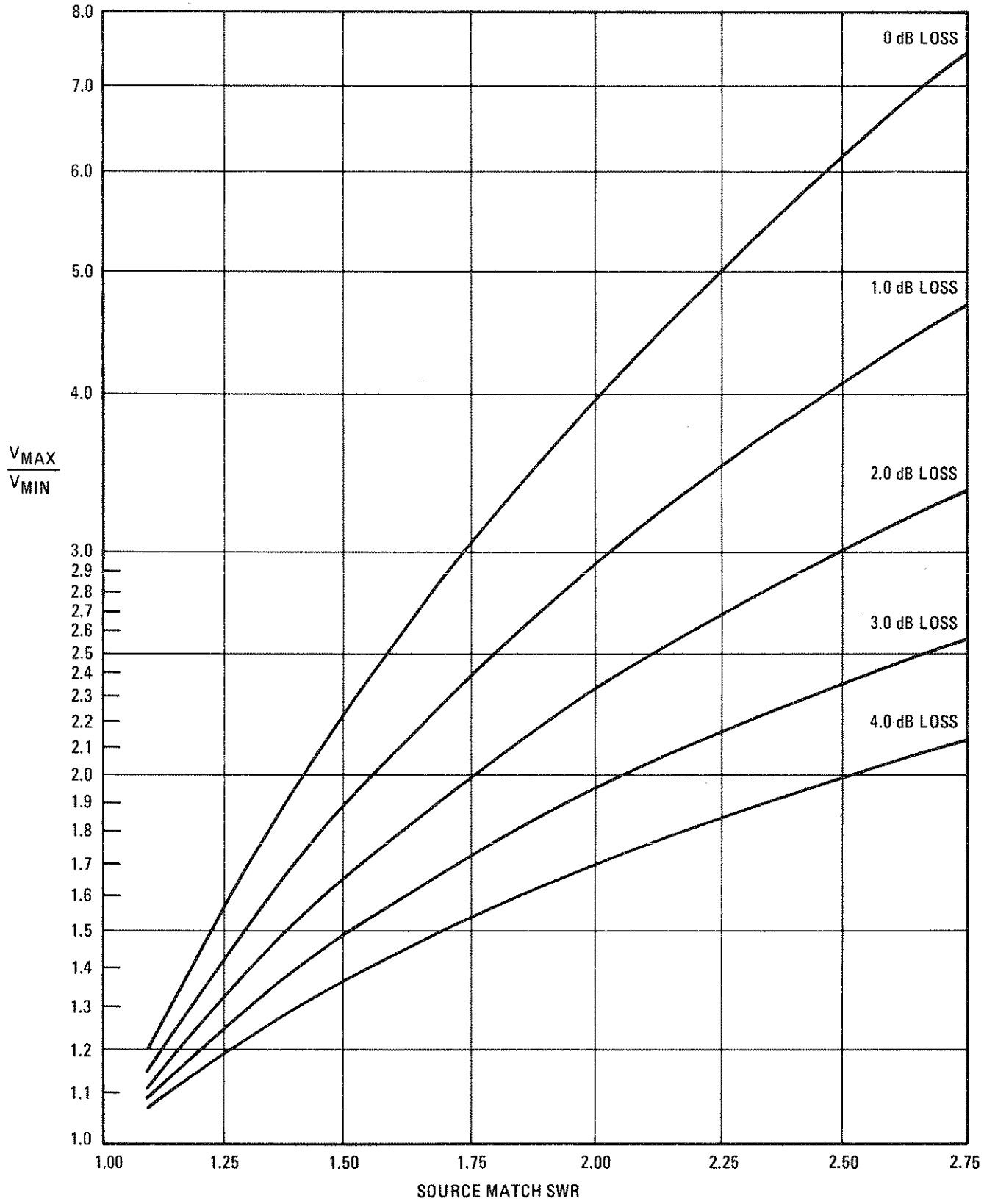


Figure 4-12. Conversion of Oscilloscope Trace to Source Match SWR

4-19. RESIDUAL AM

SPECIFICATION:

Residual AM in 100 kHz Bandwidth: ≥50 dB (in dB below carrier and at specified maximum leveled power).

DESCRIPTION:

The RF Output signal from the RF Plug-in is amplitude modulated with a square wave from the 8350A. This modulated signal is used to establish a reference on the RMS voltmeter that is 9 dB below actual carrier signal. The 9 dB reduction occurs because of voltmeter response to square wave and square-law response of crystal detector. Modulation is then removed and the magnitude of the Residual AM component is measured with respect to established reference.

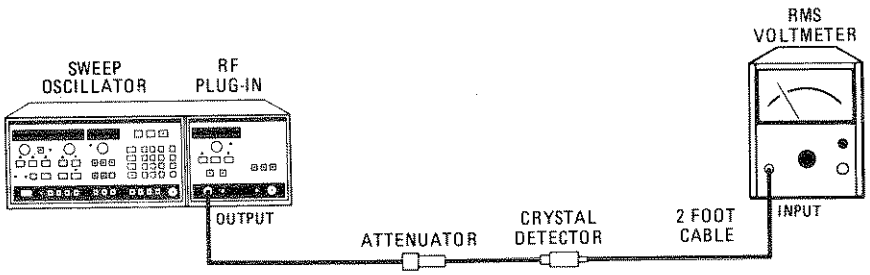


Figure 4-13. Residual AM Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8350A
RMS Voltmeter	HP 3400A
Crystal Detector	HP 8470B Option 012
Attenuator	Refer to PROCEDURE
60 cm (24 in) cable (Limits bandwidth to approximately 100 kHz)	HP 11170B

PROCEDURE:

1. Connect equipment as shown in Figure 4-13 using a 20 dB attenuator.
2. Press INSTR PRESET , CW , engage ⊔⊓ MOD (1 kHz or 27.8 kHz), disengage DISPL BLANK .

NOTE

A 41 dB decrease in the RMS voltmeter indication corresponds to a 50-dB reduction in signal level. A correction factor of 9 dB is added because of the RMS voltmeter response to a square wave and the square-law response of the crystal detector.

3. Set POWER LEVEL to +10 dBm and CW frequency to 6 GHz.
4. Vary attenuation using 3 dB, 6 dB, and 10 dB attenuators until reading on RMS voltmeter is −28 dB ±3 dB. Note voltmeter reading.

4-19. RESIDUAL AM (Cont'd)

5. Disengage ⌐¬ MOD . Change RMS voltmeter range switch to obtain an on-scale indication. Calculate the difference between this reading and the indication noted in step 4. Add 9 dB to compensate for square-law inequities, and verify this meets the tolerance in Table 4-13.

6. Engage ⌐¬ MOD . Repeat steps 4 and 5 for frequencies given in Table 4-13.

Table 4-13. Residual AM

Band	CW Frequency	Residual AM (dB below carrier)
Band 1	6.0 GHz	>50 dB
Band 2	12.0 GHz	>50 dB
Band 3	18.0 GHz	>50 dB

4-20. EXTERNAL FREQUENCY MODULATION TEST

SPECIFICATION:

Modulation Frequency	Cross-Over Coupled	Direct Coupled
DC to 100 Hz:	±75 MHz	±12 MHz
100 Hz to 1 MHz:	±7 MHz	±7 MHz
1 MHz to 2 MHz:	±5 MHz	±5 MHz
2 MHz to 10 MHz:	±1 MHz	±1 MHz

DESCRIPTION:

The RF Output is modulated with an external signal at 100 Hz, 1 MHz, 2 MHz and 10 MHz. The 100 Hz deviation is measured directly on a spectrum analyzer. The deviation at the higher frequencies is found by using a delay line discriminator to observe an increase in the modulation on an oscilloscope until distortion is observed. This frequency change is measured on a frequency counter.

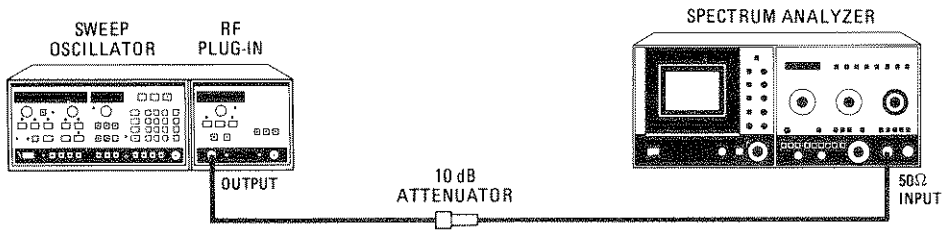


Figure 4-14. 100 Hz External Frequency Modulation Test Setup

4-20. EXTERNAL FREQUENCY MODULATION TEST (Cont'd)

EQUIPMENT:

Sweep Oscillator	HP 8350A
Spectrum Analyzer	HP 8565A
Frequency Counter	HP 5343A
Function Generator	HP 3312A
Oscilloscope	Any general purpose oscilloscope such as HP 1222A* or 1740A
0 dB Attenuator	HP 8491B Option 010
Power Splitter	HP 11667A
Delay Line Discriminator	(See Figure 1-3)

* Add a 50Ω load and BNC Tee to each oscilloscope input.

PROCEDURE:

100 Hz Modulation

1. Ensure that modulation sensitivity is set to −20 MHz/volt and modulation coupling to DC (see Figure 3-10 Configuration Switch). Connect equipment as shown in Figure 4-14.

2. Press 8350A INSTR PRESET, CW and disengage the DISPL BLANK key. Disengage RF Plug-in CW FILTER key. Center fundamental signal on spectrum analyzer CRT display. Set function generator frequency to 100 Hz sinewave and amplitude to full counterclockwise. Adjust function generator amplitude control slowly clockwise while monitoring display on spectrum analyzer. Deviation from center line should be symmetrical at first then become non-symmetrical as deviation increases.

3. Note point at which deviation becomes non-symmetrical and verify that it is greater than ±12 MHz.

4. Turn 8350A LINE switch to off. Remove RF Plug-in and switch modulation coupling to crossover (see Figure 3-10 Configuration Switch). Install the RF Plug-in and turn the 8350A line switch to ON. Then repeat steps 2 and 3. The highest symmetrical deviation frequency should be greater than ±75 MHz.

>100 Hz FM Modulation

5. Set function generator frequency to 1 MHz. Set both oscilloscope inputs to 50Ω.

6. Set function generator output amplitude to 0.1 volt p-p output. Connect equipment as shown in Figure 4-15 with function generator output not connected. Adjust CW and CW VERNIER for a delay line discriminator output of 0 volts as observed on Channel A of the oscilloscope. Note frequency counter reading.

4-20. EXTERNAL FREQUENCY MODULATION TEST (Cont'd)

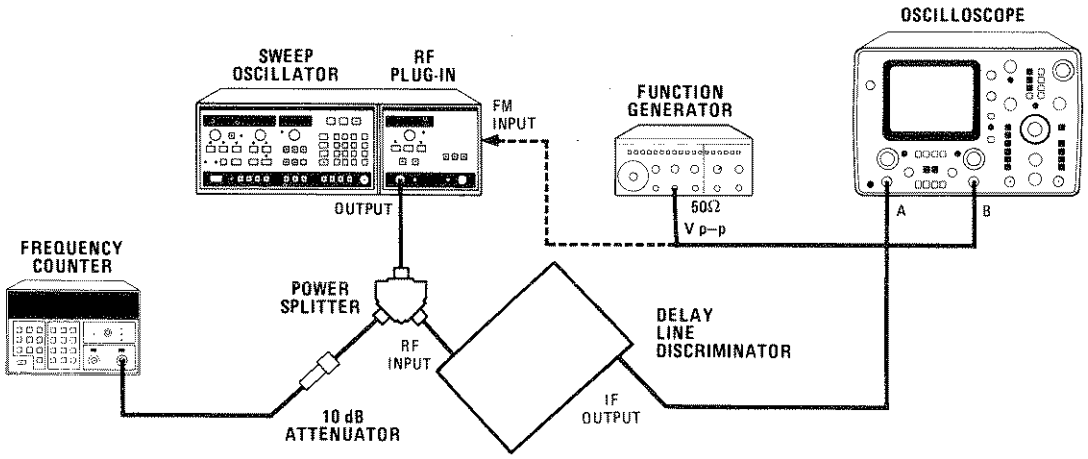


Figure 4-15. >100 Hz Frequency Modulation Test Setup

7. Connect the function generator output to 8350A FM INPUT (rear panel) and adjust Channel A of the oscilloscope for a clear display of the function generator sinewave.

8. Increase the function generator output amplitude until the deviation displayed on Channel A becomes non-symmetrical or distorted. Use Channel B of the oscilloscope to monitor the function generator output. If the output is offset the test is invalid.

9. Mark the peak of the sinewave displayed on Channel A with a grease pencil. Remove the function generator output from FM INPUT and adjust CW/CW VERNIER to the grease pencil mark. Calculate the difference between the present frequency counter reading and the previous reading (step 6). Verify frequency difference is greater than minimum given in Table 4-14 below for the FM frequency range tested.

10. Repeat steps 6 through 9 with the function generator set at 2 MHz and at 10 MHz. Verify the results according to Table 4-14 below.

11. Change mode of Plug-in modulation coupling and repeat steps 6 through 10. Verify the results according to Table 4-14 below.

Table 4-14. External Frequency Modulation

Modulation Frequency	Direct Coupled	Cross-Over Coupled
1 MHz	±7 MHz	±7 MHz
2 MHz	±5 MHz	±5 MHz
10 MHz	±1 MHz	±1 MHz

4-21. AM ON/OFF RATIO AND SQUARE WAVE SYMMETRY TEST

SPECIFICATION:

On/Off Ratio: ≥30 dB

Symmetry: 40/60

DESCRIPTION:

The AM ON/OFF ratio is checked on the amplitude axis of a video triggered spectrum analyzer display. The symmetry is checked by calculating the on/off time ratio on the frequency axis.

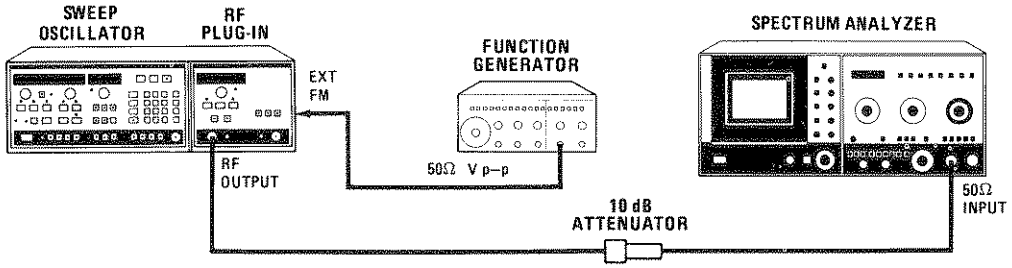


Figure 4-16. AM ON/OFF Ratio and Square Wave Symmetry Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8350A
10 dB Attenuator	HP 8491B Option 020
Spectrum Analyzer	HP 8565A

PROCEDURE:

1. Connect equipment as shown in Figure 4-16. Press 8350A INSTR PRESET CW 4 GHz and engage ⊔⊓ MOD . Set 83590A POWER LEVEL to +10 dBm.

2. Set controls as follows:

   8565A:

   Set all Normal settings (controls marked with green)

FREQUENCY BAND GHZ	3.8 to 8.5 GHz
INPUT ATTENUATION	10 dB
REFERENCE LEVEL	10 dBm
FREQUENCY SPAN MODE	ZERO SPAN
SWEEP TRIGGER	VIDEO
RESOLUTION BW	3 MHz
AUTO STABILIZER	OFF
SWEEP TIME/DIV	.1msec for 1 kHz
	5μsec for 27.8 kHz

4-21. AM ON/OFF RATIO AND SQUARE WAVE SYMMETRY TEST (Cont'd)

3. Adjust spectrum analyzer TUNING control to center 4 GHz signal on CRT. Adjust REFERENCE LEVEL to set signal on top trace. Verify that the AM ON/OFF ratio (peak-to-peak signal variation) is greater than 30 dB.

4. Verify that the squarewave symmetry of the observed signal is between 40 and 60 percent.

4-22. STEP ATTENUATOR ACCURACY TEST (OPTION 002)

SPECIFICATION:

Attenuator Accuracy	Attenuator Setting (dB)						
	10	20	30	40	50	60	70
2.0 to 12.4 GHz	0.6	0.7	0.9	1.8	2.0	2.2	2.3
12.4 to 18 GHz	0.7	0.9	1.2	2.0	2.3	2.5	2.8
18 to 20 GHz	0.9	1.3	2.5	3.0	3.2	3.3	3.5

DESCRIPTION:

The Plug-in RF output is compared to a specially calibrated attenuator and displayed on a spectrum analyzer.

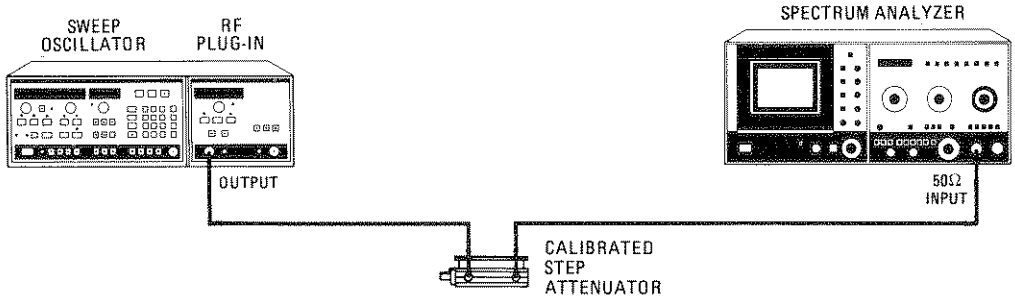


Figure 4-17. Attenuator Accuracy Test Setup

EQUIPMENT:

Sweep Oscillator ..... HP 8350A
Step Attenuator ..... HP 8495A Opt. 890
Spectrum Analyzer ..... HP 8565A

4-22. STEP ATTENUATOR ACCURACY TEST (OPTION 002) (Cont'd)

PROCEDURE:

1. Connect equipment as shown in Figure 4-17. Press 8350A INSTR PRESET , CW 4 GHz . Set the 83590A POWER LEVEL to +4 dBm.

2. Set controls as follows:

   Step Attenuator

   ATTENUATION ..... 70 dB

   Spectrum Analyzer

   Set all normal settings (controls marked with green)
   INPUT ATTEN ..... 10 dB
   REFERENCE LEVEL ..... −50 dBm
   RESOLUTION BANDWIDTH ..... 1 MHz
   FREQUENCY SPAN/DIV ..... 5 MHz
   FREQUENCY SPAN MODE ..... FULL BAND
   VIDEO FILTER ..... Adjust as necessary
   FREQUENCY BAND ..... 3.8 to 8.5 GHz

3. Press 8350A POWER LEVEL , STEP SIZE , 1 , 0 , and dBm/dB .

4. Note the actual attenuation values on the calibrated step attenuator's (Option 890) calibration report at the frequency and attenuation steps used. Calculate the Reference Attenuation Error for each step as shown below; record this error in the Attenuation Error column of Table 4-15.

   Attenuation Error = (Cal. Ref Atten. − Cal. Step Atten.) − (Ref. Setting − Step Setting)

   For example, with a Reference setting of 70 dB, the calculation for the 30 dB step setting is as follows (Note that the actual attenuation stepped in this example is 38.75 dB (69.55 dB − 30.80 dB) :

   Example Calibration Report values:

   70 dB setting is actually 69.55 dB
   30 dB setting is actually 30.80 dB

   Attenuation Error = (69.55 dB − 30.80 dB) − (70 dB − 30 dB) = −1.25 dB

5. Adjust spectrum analyzer TUNING control to center notch on Sweep Oscillator output signal. Reduce spectrum analyzer FREQUENCY SPAN/DIV to .2 MHz and recenter TUNING control. Press FREQUENCY SPAN MODE ZERO SPAN key and adjust FINE TUNING to peak signal on spectrum analyzer display. Adjust spectrum analyzer REFERENCE LEVEL VERNIER for a trace at the center graticule line. Press 1 dB/DIV and recenter trace.

6. Press the 8350A ▼ key and decrease the reference attenuation by 10 dB.

4-22. STEP ATTENUATOR ACCURACY TEST (OPTION 002) (Cont'd)

7. Record the power level variation from the center graticule (reference) on the spectrum analyzer display (be sure to designate the direction of change: + is above and − is below the reference).

8. Algebraically add the Attenuation Error and Deviation from 0 reference and record the sum in the Attenuator Accuracy column of Table 4-15 below. Repeat steps 6 and 7 for the other attenuation values.

Table 4-15. Step Attenuator Accuracy

Reference Setting =70 dB	Attenuation Error	Deviation from 0 ref	Attenuator Accuracy
70–60	_____	_____	_____
70–50	_____	_____	_____
70–40	_____	_____	_____
70–30	_____	_____	_____
70–20	_____	_____	_____
70–10	_____	_____	_____
70–0	_____	_____	_____

9. Press 8350A CW 1 5 GHz . Repeat the test at 15 GHz.

10. Press 8350A CW 1 8 GHz . Repeat the test at 18 GHz.

Table 4-16. Performance Test Record (1 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-13. Frequency Range and Accuracy					
CW Accuracy					
	4.	Start frequency = 2.0 GHz			2.0 GHz
	5.	Stop frequency = 20 GHz	20 GHz		
2.0 to 7.0 GHz: ±5 MHz	6.	CW frequency = 4 GHz	3.995 GHz	_____	4.005 GHz
		CW frequency = 2.0 GHz	1.995 GHz	_____	2.005 GHz
		CW frequency = 7.0 GHz	6.995 GHz	_____	7.005 GHz
7.0 to 13.5 GHz: ±10 MHz		CW frequency = 10 GHz	9.99 GHz	_____	10.01 GHz
		CW frequency = 7.1 GHz	7.09 GHz	_____	7.11 GHz
		CW frequency = 13.5 GHz	13.49 GHz	_____	13.51 GHz
13.5 to 20 GHz: ±15 MHz		CW frequency = 17.0 GHz	16.985 GHz	_____	17.015 GHz
		CW frequency = 14.0 GHz	13.985 GHz	_____	14.015 GHz
		CW frequency = 20.0 GHz	19.985 GHz	_____	20.015 GHz
Swept Frequency Accuracy					
2.0 to 20 GHz: ±50 MHz	9.	Start frequency = 2.0 GHz	1.95 GHz	_____	2.05 GHz
	10.	Stop frequency = 20 GHz	19.95 GHz	_____	20.05 GHz
2.0 to 7.0 GHz: ±20 MHz	11.	Start frequency = 2.0 GHz	1.98 GHz	_____	2.02 GHz
		Stop frequency = 7.0 GHz	6.98 GHz	_____	7.02 GHz
7.0 to 13.5 GHz: ±25 MHz		Start frequency = 7.0 GHz	6.975 GHz	_____	7.025 GHz
		Stop frequency = 13.5 GHz	13.475 GHz	_____	13.525 GHz
13.5 to 20 GHz: ±30 MHz		Start frequency = 13.5 GHz	13.47 GHz	_____	13.53 GHz
		Stop frequency = 20 GHz	19.97 GHz	_____	20.03 GHz
Marker Accuracy					
2.0 to 20 GHz: ±140 MHz	14.	M1 = 3 GHz	2.86 GHz	_____	3.14 GHz
		M2 = 6 GHz	5.86 GHz	_____	6.14 GHz
		M3 = 10 GHz	9.86 GHz	_____	10.14 GHz
		M4 = 14 GHz	13.86 GHz	_____	14.14 GHz
		M5 = 18 GHz	17.86 GHz	_____	18.14 GHz
2.0 to 7 GHz: ±45 MHz	15.	M1 = 3 GHz	2.955 GHz	_____	3.045 GHz
		M2 = 6 GHz	5.955 GHz	_____	6.045 GHz
7 to 13.5 GHz: ±58 MHz		M1 = 8 GHz	7.942 GHz	_____	8.058 GHz
		M2 = 12 GHz	11.942 GHz	_____	12.058 GHz
13.5 to 20 GHz: ±63 MHz		M1 = 15 GHz	14.937 GHz	_____	15.063 GHz
		M2 = 18 GHz	17.937 GHz	_____	18.063 GHz
4-14. Output Amplitude					
Power Variations at Max. Power:	6.	2.0 to 7.0 GHz @ +10 dBm	+10 dBm	_____	+11.4 dBm

Table 4-16. Performance Test Record (2 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
Power Variations at Max Power: (Cont'd)	7.	7.0 to 13.5 GHz @ +10 dBm	+10 dBm	_____	+11.4 dBm
		13.5 to 18.6 GHz @ +10 dBm	+10 dBm	_____	+11.6 dBm
		13.5 to 20 GHz @ +8 dBm	+8 dBm	_____	+9.6 dBm
		2.0 to 18.6 GHz @ +10 dBm	+10 dBm	_____	+11.8 dBm
		2.0 to 20 GHz @ +8 dBm	+8 dBm	_____	+9.8 dBm
Option 002:	6.	2.0 to 7.0 GHz @ +8.5 dBm	+8.5 dBm	_____	+9.9 dBm
	7.	7.0 to 13.5 GHz @ +8 dBm	+8 dBm	_____	+9.4 dBm
		13.5 to 18.6 GHz @ +7 dBm	+7 dBm	_____	+8.6 dBm
		13.5 to 20 GHz @ +5 dBm	+5 dBm	_____	+6.6 dBm
		2.0 to 18.6 GHz @ +7 dBm	+7 dBm	_____	+8.8 dBm
		2.0 to 20 GHz @ +5 dBm	+5 dBm	_____	+6.8 dBm
Power Level Accuracy 2.0 to 7.0 GHz	9.	Power = +10 dBm	+8.7 dBm	_____	+11.3 dBm
	10.	= +9 dBm	+7.7 dBm	_____	+10.3 dBm
	11.	= +8 dBm	+6.7 dBm	_____	+9.3 dBm
		= +7 dBm	+5.7 dBm	_____	+8.3 dBm
		= +6 dBm	+4.7 dBm	_____	+7.3 dBm
		= +5 dBm	+3.7 dBm	_____	+6.3 dBm
		= +4 dBm	+2.7 dBm	_____	+5.3 dBm
		= +3 dBm	+1.7 dBm	_____	+4.3 dBm
		= +2 dBm	+0.7 dBm	_____	+3.3 dBm
		= +1 dBm	−0.3 dBm	_____	+2.3 dBm
		= 0 dBm	−1.3 dBm	_____	+1.3 dBm
		= −1 dBm	−2.3 dBm	_____	+0.3 dBm
		= −2 dBm	−3.3 dBm	_____	−0.7 dBm
		= −3 dBm	−4.3 dBm	_____	−1.7 dBm
		= −4 dBm	−5.3 dBm	_____	−2.7 dBm
		= −5 dBm	−6.3 dBm	_____	−3.7 dBm
7.0 to 13.5 GHz	9.	Power = +10 dBm	+8.7 dBm	_____	+11.3 dBm
	10.	= +9 dBm	+7.7 dBm	_____	+10.3 dBm
	11.	= +8 dBm	+6.7 dBm	_____	+9.3 dBm
		= +7 dBm	+5.7 dBm	_____	+8.3 dBm
		= +6 dBm	+4.7 dBm	_____	+7.3 dBm
		= +5 dBm	+3.7 dBm	_____	+6.3 dBm
		= +4 dBm	+2.7 dBm	_____	+5.3 dBm
		= +3 dBm	+1.7 dBm	_____	+4.3 dBm
		= +2 dBm	+0.7 dBm	_____	+3.3 dBm
		= +1 dBm	−0.3 dBm	_____	+2.3 dBm
		= 0 dBm	−1.3 dBm	_____	+1.3 dBm
		= −1 dBm	−2.3 dBm	_____	+0.3 dBm
		= −2 dBm	−3.3 dBm	_____	−0.7 dBm
		= −3 dBm	−4.3 dBm	_____	−1.7 dBm
		= −4 dBm	−5.3 dBm	_____	−2.7 dBm
		= −5 dBm	−6.3 dBm	_____	−3.7 dBm
13.5 to 18.6 GHz	9.	Power = +10 dBm	+8.6 dBm	_____	+11.4 dBm
	10.	= +9 dBm	+7.6 dBm	_____	+10.4 dBm

Table 4-16. Performance Test Record (3 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
13.5 to 18.6 GHz (Cont'd)	11.	= +8 dBm	+6.6 dBm	_____	+9.4 dBm
		= +7 dBm	+5.6 dBm	_____	+8.4 dBm
		= +6 dBm	+4.6 dBm	_____	+7.4 dBm
		= +5 dBm	+3.6 dBm	_____	+6.4 dBm
		= +4 dBm	+2.6 dBm	_____	+5.4 dBm
		= +3 dBm	+1.6 dBm	_____	+4.4 dBm
		= +2 dBm	+0.6 dBm	_____	+3.4 dBm
		= +1 dBm	−0.4 dBm	_____	+2.4 dBm
		= 0 dBm	−1.4 dBm	_____	+1.4 dBm
		= −1 dBm	−2.4 dBm	_____	+0.4 dBm
		= −2 dBm	−3.4 dBm	_____	−0.6 dBm
		= −3 dBm	−4.4 dBm	_____	−1.6 dBm
		= −4 dBm	−5.4 dBm	_____	−2.6 dBm
		= −5 dBm	−6.4 dBm	_____	−3.6 dBm
13.5 to 20 GHz	9.	Power = +8 dBm	+6.6 dBm	_____	+9.4 dBm
	10.	= +7 dBm	+5.6 dBm	_____	+8.4 dBm
	11.	= +6 dBm	+4.6 dBm	_____	+7.4 dBm
		= +5 dBm	+3.6 dBm	_____	+6.4 dBm
		= +4 dBm	+2.6 dBm	_____	+5.4 dBm
		= +3 dBm	+1.6 dBm	_____	+4.4 dBm
		= +2 dBm	+0.6 dBm	_____	+3.4 dBm
		= +1 dBm	−0.4 dBm	_____	+2.4 dBm
		= 0 dBm	−1.4 dBm	_____	+1.4 dBm
		= −1 dBm	−2.4 dBm	_____	+0.4 dBm
		= −2 dBm	−3.4 dBm	_____	−0.6 dBm
		= −3 dBm	−4.4 dBm	_____	−1.6 dBm
		= −4 dBm	−5.4 dBm	_____	−2.6 dBm
		= −5 dBm	−6.4 dBm	_____	−3.6 dBm
2.0 to 18.6 GHz	9.	Power = +10 dBm	+8.5 dBm	_____	+11.5 dBm
	10.	= +9 dBm	+7.5 dBm	_____	+10.5 dBm
	11.	= +8 dBm	+6.5 dBm	_____	+9.5 dBm
		= +7 dBm	+5.5 dBm	_____	+8.5 dBm
		= +6 dBm	+4.5 dBm	_____	+7.5 dBm
		= +5 dBm	+3.5 dBm	_____	+6.5 dBm
		= +4 dBm	+2.5 dBm	_____	+5.5 dBm
		= +3 dBm	+1.5 dBm	_____	+4.5 dBm
		= +2 dBm	+0.5 dBm	_____	+3.5 dBm
		= +1 dBm	−0.5 dBm	_____	+2.5 dBm
		= 0 dBm	−1.5 dBm	_____	+1.5 dBm
		= −1 dBm	−2.5 dBm	_____	+0.5 dBm
		= −2 dBm	−3.5 dBm	_____	−0.5 dBm
		= −3 dBm	−4.5 dBm	_____	−1.5 dBm
		= −4 dBm	−5.5 dBm	_____	−2.5 dBm
		= −5 dBm	−6.5 dBm	_____	−3.5 dBm
2.0 to 20 GHz	9.	Power = +8 dBm	+6.5 dBm	_____	+9.5 dBm
	10.	= +7 dBm	+5.5 dBm	_____	+8.5 dBm

Table 4-16. Performance Test Record (4 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
2.0 to 20 GHz (Cont'd)	11.	= +6 dBm	+4.5 dBm	_____	+7.5 dBm
		= +5 dBm	+3.5 dBm	_____	+6.5 dBm
		= +4 dBm	+2.5 dBm	_____	+5.5 dBm
		= +3 dBm	+1.5 dBm	_____	+4.5 dBm
		= +2 dBm	+0.5 dBm	_____	+3.5 dBm
		= +1 dBm	−0.5 dBm	_____	+2.5 dBm
		= 0 dBm	−1.5 dBm	_____	+1.5 dBm
		= −1 dBm	−2.5 dBm	_____	+0.5 dBm
		= −2 dBm	−3.5 dBm	_____	−0.5 dBm
		= −3 dBm	−4.5 dBm	_____	−1.5 dBm
		= −4 dBm	−5.5 dBm	_____	−2.5 dBm
		= −5 dBm	−6.5 dBm	_____	−3.5 dBm
Option 002:					
2.0 to 7.0 GHz	9.	Power = +8.5 dBm	+7 dBm	_____	+10 dBm
	10.	= +7.5 dBm	+6 dBm	_____	+9 dBm
	11.	= +6.5 dBm	+5 dBm	_____	+8 dBm
		= +5.5 dBm	+4 dBm	_____	+7 dBm
		= +4.5 dBm	+3 dBm	_____	+6 dBm
		= +3.5 dBm	+2 dBm	_____	+5 dBm
		= +2.5 dBm	+1 dBm	_____	+4 dBm
		= +1.5 dBm	0 dBm	_____	+3 dBm
		= +0.5 dBm	−1 dBm	_____	+2 dBm
		= −0.5 dBm	−2 dBm	_____	+1 dBm
		= −1.5 dBm	−3 dBm	_____	0 dBm
		= −2.5 dBm	−4 dBm	_____	−1 dBm
		= −3.5 dBm	−5 dBm	_____	−2 dBm
		= −4.5 dBm	−6 dBm	_____	−3 dBm
		= −5 dBm	−6.5 dBm	_____	−3.5 dBm
7.0 to 13.5 GHz	9.	Power = +8 dBm	+6.5 dBm	_____	+9.5 dBm
	10.	= +7 dBm	+5.5 dBm	_____	+8.5 dBm
	11.	= +6 dBm	+4.5 dBm	_____	+7.5 dBm
		= +5 dBm	+3.5 dBm	_____	+6.5 dBm
		= +4 dBm	+2.5 dBm	_____	+5.5 dBm
		= +3 dBm	+1.5 dBm	_____	+4.5 dBm
		= +2 dBm	+0.5 dBm	_____	+3.5 dBm
		= +1 dBm	−0.5 dBm	_____	+2.5 dBm
		= 0 dBm	−1.5 dBm	_____	+1.5 dBm
		= −1 dBm	−2.5 dBm	_____	+0.5 dBm
		= −2 dBm	−3.5 dBm	_____	−0.5 dBm
		= −3 dBm	−4.5 dBm	_____	−1.5 dBm
		= −4 dBm	−5.5 dBm	_____	−2.5 dBm
		= −5 dBm	−6.5 dBm	_____	−3.5 dBm
13.5 to 18.6 GHz	9.	Power = +7 dBm	+5.4 dBm	_____	+8.6 dBm
	10.	= +6 dBm	+4.4 dBm	_____	+7.6 dBm
	11.	= +5 dBm	+3.4 dBm	_____	+6.6 dBm

Table 4-16. Performance Test Record (5 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
13.5 to 18.6 (Cont'd)		= +4 dBm	+2.4 dBm	_____	+5.6 dBm
		= +3 dBm	+1.4 dBm	_____	+4.6 dBm
		= +2 dBm	+0.4 dBm	_____	+3.6 dBm
		= +1 dBm	−0.6 dBm	_____	+2.6 dBm
		= 0 dBm	−1.6 dBm	_____	+1.6 dBm
		= −1 dBm	−2.6 dBm	_____	+0.6 dBm
		= −2 dBm	−3.6 dBm	_____	−0.4 dBm
		= −3 dBm	−4.6 dBm	_____	−1.4 dBm
		= −4 dBm	−5.6 dBm	_____	−2.4 dBm
		= −5 dBm	−6.6 dBm	_____	−3.4 dBm
13.5 to 20 GHz	9.	Power = +5 dBm	+3.4 dBm	_____	+6.6 dBm
	10.	= +4 dBm	+2.4 dBm	_____	+5.6 dBm
	11.	= +3 dBm	+1.4 dBm	_____	+4.6 dBm
		= +2 dBm	+0.4 dBm	_____	+3.6 dBm
		= +1 dBm	−0.6 dBm	_____	+2.6 dBm
		= 0 dBm	−1.6 dBm	_____	+1.6 dBm
		= −1 dBm	−2.6 dBm	_____	+0.6 dBm
		= −2 dBm	−3.6 dBm	_____	−0.4 dBm
		= −3 dBm	−4.6 dBm	_____	−1.4 dBm
		= −4 dBm	−5.6 dBm	_____	−2.4 dBm
		= −5 dBm	−6.6 dBm	_____	−3.4 dBm
2.0 to 18.6 GHz	9.	Power = +7 dBm	+5.3 dBm	_____	+8.7 dBm
	10.	= +6 dBm	+4.3 dBm	_____	+7.7 dBm
	11.	= +5 dBm	+3.3 dBm	_____	+6.7 dBm
		= +4 dBm	+2.3 dBm	_____	+5.7 dBm
		= +3 dBm	+1.3 dBm	_____	+4.7 dBm
		= +2 dBm	+0.3 dBm	_____	+3.7 dBm
		= +1 dBm	−0.7 dBm	_____	+2.7 dBm
		= 0 dBm	−1.7 dBm	_____	+1.7 dBm
		= −1 dBm	−2.7 dBm	_____	+0.7 dBm
		= −2 dBm	−3.7 dBm	_____	−0.3 dBm
		= −3 dBm	−4.7 dBm	_____	−1.3 dBm
		= −4 dBm	−5.7 dBm	_____	−2.3 dBm
		= −5 dBm	−6.7 dBm	_____	−3.3 dBm
2.0 to 20 GHz	9.	Power = +5 dBm	+3.3 dBm	_____	+6.7 dBm
	10.	= +4 dBm	+2.3 dBm	_____	+5.7 dBm
	11.	= +3 dBm	+1.3 dBm	_____	+4.7 dBm
		= +2 dBm	+0.3 dBm	_____	+3.7 dBm
		= +1 dBm	−0.7 dBm	_____	+2.7 dBm
		= 0 dBm	−1.7 dBm	_____	+1.7 dBm
		= −1 dBm	−2.7 dBm	_____	+0.7 dBm
		= −2 dBm	−3.7 dBm	_____	−0.3 dBm
		= −3 dBm	−4.7 dBm	_____	−1.3 dBm
		= −4 dBm	−5.7 dBm	_____	−2.3 dBm
		= −5 dBm	−6.7 dBm	_____	−3.3 dBm

Table 4-16. Performance Test Record (6 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
Power Sweep	12.	Power Level = −5 dBm			
2.0 to 7.0 GHz			+10 dBm	_____	
7.0 to 13.5 GHz	13.		+10 dBm	_____	
13.5 to 18.6 GHz			+10 dBm	_____	
13.5 to 20 GHz			+ 8 dBm	_____	
2.0 to 18.6 GHz			+10 dBm	_____	
2.0 to 20 GHz			+ 8 dBm	_____	
Option 002	12.	Power Level = −5 dBm			
2.0 to 7.0 GHz			+8.5 dBm	_____	
7.0 to 13.5 GHz	13.		+8 dBm	_____	
13.5 to 18.6 GHz			+7 dBm	_____	
13.5 to 20 GHz			+5 dBm	_____	
2.0 to 18.6 GHz			+7 dBm	_____	
2.0 to 20 GHz			+5 dBm	_____	
Power Meter Leveled					
<±0.2 dB	20.			_____	<±0.2 dB
Crystal Det. Leveled					
<±0.2 dB	24.			_____	<±0.2 dB
4-15. Frequency Stability					
10% Line Voltage Change:					
Band 1, 6 GHz: <±50 kHz	3.	Low line frequency change		_____	<±50 kHz
	4.	High line frequency change		_____	<±50 kHz
Band 2, 12 GHz: <±100 kHz	5.	Low line frequency change		_____	<±100 kHz
		High line frequency change		_____	<±100 kHz
Band 3, 18 GHz: <±150 kHz		Low line frequency change		_____	<±150 kHz
		High line frequency change		_____	<±150 kHz
Time (10 minutes):					
Band 1, 6 GHz: ≤±100 kHz	7.	Maximum deviation in 10 minutes		_____	≤±100 kHz
Band 2, 12 GHz: ≤±200 kHz	8.	Maximum deviation in 10 minutes		_____	≤±200 kHz
Band 3, 18 GHz: ≤±300 kHz		Maximum deviation in 10 minutes		_____	≤±300 kHz
10 dB Power Change:					
Band 1, 6 GHz: ≤±200 kHz	10.	Frequency change with power		_____	≤±200 kHz
Band 2, 12 GHz: ≤±400 kHz	11.	Frequency change with power		_____	≤±400 kHz
Band 3, 18 GHz: ≤±600 kHz		Frequency change with power		_____	≤±600 kHz
3:1 Load SWR:					
Band 1, 6 GHz: ≤±100 kHz	15.	3:1 SWR		_____	≤±100 kHz
Band 2, 12 GHz: ≤±200 kHz	16.	3:1 SWR		_____	≤±200 kHz
Band 3, 18 GHz: ≤±300 kHz		3:1 SWR		_____	≤±300 kHz

Table 4-16. Performance Test Record (7 of 8)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-16. Residual FM					
2.0 to 7 GHz: <5 kHz	17.	CW frequency = 6 GHz		_____	<5 kHz
7.0 to 13.5 GHz: <7 kHz	18.	CW frequency = 12 GHz		_____	<7 kHz
13.5 to 20 GHz: <9 kHz		CW frequency = 18 GHz		_____	<9 kHz
4-17. Spurious Signals					
Harmonic:					
2.0 to 7 GHz: >−25 dB	3.	Measure relative to carrier	>−25 dB	_____	
7 to 13.5 GHz: >−25 dB			>−25 dB	_____	
13.5 to 20 GHz: >−25 dB			>−25 dB	_____	
Non-harmonic:					
2.0 to 7 GHz: >−50 dB			>−50 dB	_____	
7 to 13.5 GHz: >−50 dB			>−50 dB	_____	
13.5 to 20 GHz: >−50 dB			>−50 dB	_____	
4-18. Output SWR					
Standard: <1.9	5.	Range: 2 to 18 GHz		_____	<1.9
Option 002: <2.1				_____	<2.1
4-19. Residual AM					
6 GHz: ≥−50 dB	5.	Measure relative to carrier		_____	≥−50 dB
12 GHz: ≥−50 dB				_____	≥−50 dB
18 GHz: ≥−50 dB				_____	≥−50 dB
6 GHz: ≥−50 dB	6.	Measure relative to carrier		_____	≥−50 dB
12 GHz: ≥−50 dB				_____	≥−50 dB
18 GHz: ≥−50 dB				_____	≥−50 dB
4-20. External FM					
Direct Coupled:	1.	A3S1: Close switch 5, open 6			
DC to 100 Hz: ≥±12 MHz	3.		≥±12 MHz	_____	
Cross Over Coupled:	4.	A3S1: Close switch 6			
DC to 100 Hz: ≥±75 MHz			≥±75 MHz	_____	
Direct/Cross Over Coupling					
100 Hz to 1 MHz: ≥±7 MHz	9.		≥±7 MHz	_____	
1 to 2 MHz: ≥±5 MHz	10.		≥±5 MHz	_____	
2 to 10 MHz: ≥±1 MHz			≥±1 MHz	_____	
	11.	A3S1: Change switch 6 from previous setting	≥±7 MHz	_____	
			≥±5 MHz	_____	
			≥±1 MHz	_____	
4-21. AM On/Off Ratio Square-Wave Symmetry					
On/Off Ratio: >30 dB below specified maximum leveled power	1.	CW frequency = 4 GHz Power = +10 dBm			
Symmetry of ON/OFF time: 40/60	3.		>30 dB	_____	
	4.		40%	_____	60%

Table 4-16. Performance Test Record (8 of 8)

SPECIFICATIONS TESTED Limits		Step	TEST Conditions				Lower Limit	Measured Value	Upper Limit
4-22. Step Attenuator Accuracy (Option 002) (Referenced from 0 dB) 2.0 to 12.4 GHz		1. 2.	CW frequency = 4.0 GHz Power = +4.0 dBm Reference Attenuation = 70 dB						
Attn. Step	**Accuracy**		**Ref. Attn. Step**	**Attn. Error**	+	**Deviation from 0 ref.**			
10 dB	≤±0.6 dB	4.	70 − 60	_____	+	_____		_____	≤±0.6 dB
20 dB	≤±0.7 dB	7.	70 − 50	_____	+	_____		_____	≤±0.7dB
30 dB	≤±0.9 dB	8.	70 − 40	_____	+	_____		_____	≤±0.9 dB
40 dB	≤±1.8 dB		70 − 30	_____	+	_____		_____	≤±1.8 dB
50 dB	≤±2.0 dB		70 − 20	_____	+	_____		_____	≤±2.0 dB
60 dB	≤±2.2 dB		70 − 10	_____	+	_____		_____	≤±2.2 dB
70 dB	≤±2.3 dB		70 − 0	_____	+	_____		_____	≤±2.3 dB
12.4 to 18 GHz		9.	CW frequency = 15 GHz Power = +4.0 dBm Reference Attenuation = 70 dB						
Attn. Step	**Accuracy**		**Ref. Attn. Step**	**Attn. Error**	+	**Deviation from 0 ref.**			
10 dB	≤±0.7 dB		70 − 60	_____	+	_____		_____	≤±0.7 dB
20 dB	≤±0.9 dB		70 − 50	_____	+	_____		_____	≤±0.9 dB
30 dB	≤±1.2 dB		70 − 40	_____	+	_____		_____	≤±1.2 dB
40 dB	≤±2.0 dB		70 − 30	_____	+	_____		_____	≤±2.0 dB
50 dB	≤±2.3 dB		70 − 20	_____	+	_____		_____	≤±2.3 dB
60 dB	≤±2.5 dB		70 − 10	_____	+	_____		_____	≤±2.5 dB
70 dB	≤±2.8 dB		70 − 0	_____	+	_____		_____	≤±2.8 dB
10 to 20 GHz		10.	CW frequency = 18 GHz Power = +4.0 dBm Reference Attenuation = 70 dB						
Attn. Step	**Accuracy**		**Ref. Attn. Step**	**Attn. Error**	+	**Deviation from 0 ref.**			
10 dB	≤±0.9 dB		70 − 60	_____	+	_____		_____	≤±0.9 dB
20 dB	≤±1.5 dB		70 − 50	_____	+	_____		_____	≤±1.5 dB
30 dB	≤±2.5 dB		70 − 40	_____	+	_____		_____	≤±2.5 dB
40 dB	≤±3.0 dB		70 − 30	_____	+	_____		_____	≤±3.0 dB
50 dB	≤±3.2 dB		70 − 20	_____	+	_____		_____	≤±3.2 dB
60 dB	≤±3.3 dB		70 − 10	_____	+	_____		_____	≤±3.3 dB
70 dB	≤±3.5 dB		70 − 0	_____	+	_____		_____	≤±3.5 dB